

**Potential Production of
High Quality Orthodox Tea
In Rwanda,
and
Organizational Constraints
at Kitabi and Mata Units.**

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1. EXECUTIVE SUMMARY

The Rwandan Government tea privatization program is part of the on-going economic liberalization policy to encourage the private sector to become the driving force of the country's economic activity. This program had a slow start with only two factories settled into private status (Sorwathé and Pfunda) and a third withdrawn. Four more factories were scheduled for bidding in 2004, though this now appears doubtful.

The current assignment was funded by USAID, hosted by ADAR and was set up at the request of tea industry stakeholders OCIR-Thé and MIG (*Mutuelle d'Investissement de Gikongoro*).

OCIR-Thé owned Gisovu and Kitabi factories were inspected with a view to assessing their suitability for orthodox tea production, and Kitabi and Mata factories were inspected to check on their operational organization.

Gisovu has the potential to produce very high quality orthodox tea. It is situated at a high altitude close to the equator; soil is ideal for producing quality; it has a good range of clones that, despite being selected for CTC production, will translate well to Orthodox style, and will allow manufacture to be optimized to achieve the best quality from individual clones. Gisovu factory could accommodate a 500 tonne per annum orthodox line – the smallest practicable size – by freeing up existing underutilized space.

Kitabi scores slightly lower than Gisovu for orthodox production potential, but is still reasonable. Clones have been mixed in the field at Kitabi, there is less free space in the factory, necessitating some new building, and the factory infrastructure is less well maintained.

Orthodox tea machinery of the type required is now only manufactured in India and Sri Lanka. Machinery purchase price for a 500 tonne per annum black tea orthodox line is approximately US\$ 275,000, assuming that the factory has sufficient steam available from its existing boiler.

The total cost is very similar for both factories. If all product options (black tea, green tea and flavored tea) are included, complete with necessary building work, technical consultancy and three months expert training, the total investment cost is: Gisovu US\$ 480,000 to 500,000, and Kitabi US\$ 520,000 to 540,000.

Pluck standard is slightly preferred at Gisovu, but is potentially acceptable at both factories, both in BI and TV plantings. However, quality of delivered leaf is spoilt by damage incurred during transport to the factory. This damage is due primarily to overloading of trucks: it can be solved using standard procedures and, given an improvement in transport there would be an immediate increase in leaf standard to the required level for orthodox manufacture without any change in plucking methods in the field. Applied overall, the improvements in transport of green leaf would benefit CTC manufacture as well as enabling orthodox manufacture.

It is recognized that OCIR-Thé has succeeded in a difficult task of pulling the tea industry back into record production after the 1994 genocide, but the estates, factories and organization require further attention to become truly competitive in a global market. Aspects of organization that require immediate improvement include low yields, low worker productivity, the late delivery of fertilizer to estates, and the low levels of application of fertilizer, the advanced age of some factory machinery, the use of outdated process techniques, the lack of a planned preventative maintenance program, the tolerance of excessive breakdown lost time, ignoring the implications of adverse conversion ratios, and the lack of proper quality control.

Immediate attention should be given by OCIR-Thé management to these important issues. Those issues effectively resolved before privatization will enhance the value of the factories, though potential investors may well prefer to import expertise to solve the on-going problems themselves.

Rwanda is a small producer in world terms and cannot compete in the low margin volume market. Rwanda needs to exploit high value niche markets and to become recognized and respected as a world center for excellence in tea. The tea diversification strategy that has now been adopted as a national plan could swiftly put Rwanda into a pivotal position as a specialty and added value tea supplier – if all stakeholders work together and in the same direction. Given the continuing global overproduction of commodity CTC teas, this is the only tea sector survival hope that Rwanda has. A speedy move into orthodox tea production is commended as the initial step towards achieving the national tea strategy.

A presentation of findings was given to interested stakeholders at ADAR office in Kigali on 21 October 2004. This presentation is reproduced in Appendix 1.

2. ASSIGNMENT

2.1. Terms of reference

1. Study operations at Gisovu and Kitabi estates to provide detailed recommendations for the estates to successfully achieve sustainable production of high quality tea, namely:
 - planting material – in ground;
 - planting material – new planting;
 - husbandry;
 - harvesting skill;
 - harvesting effectiveness;
 - transport time;
 - transport quality;
 - technology;
 - processes ;
 - equipment.
2. Provide an estimation of the additional necessary investment for the purchase and development of orthodox tea production and processing
3. Review and evaluate the logistics and operations management systems in place at the Kitabi and Mata factories, specifically with respect to identifying factors that are constraining the production of high quality green and black tea, and identify and describe means to improve their production capacities and competitiveness.

2.2. Findings and conclusions

- Orthodox tea technology can be adapted to Rwandan conditions to produce specialty teas for niche marketing. Field conditions are generally favorable; the climate is seasonal with a two rainy periods and a three month dry season. Seasonality tends to promote a slow growth quality period that can be exploited using orthodox manufacture.
- Soil structure on hills and soil pH are both favorable for growth that is suitable for orthodox manufacture.

- Altitude is generally above 2,100 meters (6,900 feet) which gives slow growth that is conducive to the production of orthodox flavor and character.
- The eight clones available are African (assamica) types selected for CTC manufacture, but this type has proved acceptable for orthodox in Kenya. Clone TRI 6/8 has particularly good flavor.
- Pluck standard is better than would be expected from the leaf analysis records. Green leaf quality is seriously damaged by poorly managed transport that crushes leaf and causes leaf heating – this damage reduces fine leaf percentage.
- It is expected that Rwanda will be able to produce black orthodox tea at least as good as the Kenyan KTDA Kangaita production.
- The space required for a single line of 500 tonnes capacity is 900 – 1,000 m².
- The CTC factory at Gisovu has sufficient spare space to accommodate a small orthodox line of 500 tonnes per annum.
- The CTC factory at Kitabi has little usable space available within the building, but a rear courtyard can be converted by roofing in between two buildings – estimated cost between US\$ 70,000 and 90,000.
- Orthodox machinery is now made only in India and Sri Lanka. The typical cost for purchase of a black orthodox line is US\$ 275,000, excluding steam boiler and cost of building or moving existing machinery. Green tea capability would increase the cost by USD 75,000 to a total machinery cost of US\$ 350,000.
- Total investment cost is very similar for both factories. If all product options (black tea, green tea and flavored tea) are included, complete with technical consultancy and three months expert training, the cost is: Gisovu US\$ 480,000 to 500,000, and Kitabi US\$ 520,000 to 540,000.
- Marketing of specialty teas requires a very different approach compared with CTC teas sent to auction.
- The OCIR-Thé estates must engage in direct selling to customers. Sorwathé is a benchmark as they are a UK Premier Brands partner and have commenced some value addition manufacture with packed black, green and oolong teas being sold at Kigali international airport. Further good examples are the development of the private tea sectors of Nepal and Sri Lanka.

- Generic promotion of Rwanda specialty teas is required as well as direct selling by the estates. OCIR-Thé (within its new sector – the Ministry of Commerce, Industry and Tourism) or a tea board equivalent should take central responsibility for generic promotion, data collection, coordination, and making sure that the private sector have a commercial and legislative working climate conducive to attracting investment and to meeting the national strategy for tea. It may be difficult for OCIR-Thé to come to terms with its new market orientated role.
- There is a further central role in lobbying for road improvements and for Electrogaz grid power reliability improvement.
- Organization of the three OCIR-Thé factories visited was not up to the standard of privately owned tea factories within or outside Rwanda.
- Estates return very low yields and appear to have been more interested in expanding planting than improving yield. This is an expensive method of increasing production.
- The main reason for the low yield is that fertilizer application is too little, and planned rates are often not applied, or are applied too late to be effective.
- For OCIR-Thé the purchase price per unit of N applied is US\$ 1.34 per unit. The yield response of clonal tea to nitrogen is around 6 kg of made tea per unit of N applied. Priced at an auction average of US\$ 1.60 per kg this shows a return of US\$ 9.60 for every US 1.34 spent on fertilizer – an excellent cost benefit that justifies its application despite the extra transport cost that Rwanda faces on imported fertilizer.
- Sorwathé, at a price of US\$ 1.82 per unit of N, fertilize their tea sufficiently to achieve a yield 2.5 x as high as the Rwandan average.
- Plucker productivity is generally low despite incentive schemes. The effectiveness of these should be evaluated and they should be extended alongside effective training programs.
- Systems in use in other countries (for example, program scheme plucking) should be trialed in Rwanda.
- Transport of leaf to factories is badly organized, and has now been contracted out, with consequent further loss of control. Benchmark operations (Uganda, Sorwathé in Rwanda, KTDA in Kenya, Sapekoe in South Africa), have organized leaf transport to be efficient and cost effective with minimal damage. OCIR-Thé factories in Rwanda must do the same.

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- CTC lines in the factories are old fashioned and require major investment to optimize them, particularly in replacement of some CTC machinery (Kitabi and Mata), and the introduction of CFMs (continuous fermenting machines) throughout.
 - Process monitoring and quality control is rudimentary; it requires upgrading and operator training to appreciate the benefits.
 - Product loss and time loss due to factory breakdowns run at a very high level – up to nearly four hours per day during two shift working (Mata).
 - Electric power stoppages are significantly worse in 2004 than 2003 – at Kitabi up from 273 hours to 2,505 hours.
 - A tea R&D facility is desperately required in Rwanda to undertake fertilizer trials, plant material procurement and selection, initial VP propagation, productivity methods trialing, and equipment evaluation.
 - Appropriate stakeholders should have the opportunity to see and to assess good quality orthodox tea manufacture in Sri Lanka.
 - The on-the-Frontier tea strategy that has now been adopted as a national plan could quickly put Rwanda into a pivotal position as a specialty and added value tea supplier – if all stakeholders work together and in the same direction. Given the continuing global overproduction of commodity CTC teas, this is the only tea sector survival hope that Rwanda has. A speedy move into orthodox tea production is commended as the initial step towards achieving the national tea strategy.
 - Rwanda needs to become recognized and respected as a world center for excellence in tea.

2.3. Recommendations

In addition to the proposals and suggestions embedded in the text relating to orthodox manufacture feasibility and organization, the following supplementary recommendations are made:

It is recommended that:

1. The setting up of tea research station be given high priority as part of the national tea program, with an initial remit to select clones for local conditions and to suit product requirements, undertake fertilizer trials under local conditions, adapt husbandry and plucking methods to local conditions, to trial new methods, and evaluate new machinery. An effective Rwanda Tea Research Station would raise the status of Rwanda in the tea world.
2. Arrangements should be made for a group of Rwandan tea industry stakeholders to take a trip to Sri Lanka to inspect all aspects of orthodox tea manufacture, retail packing and marketing. Tea Technology Associates arranged a similar tour in 2003 for twelve stakeholders in the Georgian tea industry. This trip was found to be both instructive and motivational (see Appendix 2 for sample itinerary).
3. A biomass diesel powered cogeneration unit should be installed in one of the OCIR-Thé tea factories as a practical demonstration unit to encourage private investors to consider this method for producing reliable energy, and reducing demand on the Electrogaz grid. See Section 7.5 Cogeneration.
4. The program scheme plucking method (PSP) pioneered in the 1980s by TRFCA in Malawi (ref.7) and rapidly taken up by Kenya tea multinationals should be trialed in Rwanda as it encourages good selective plucking, reduces coarse leaf plucked, reduces absenteeism, and improves overall yield.
5. At Gisovu one 24" CTC line, including two jumbo units, is obsolete and will be removed. Note however that a single cut CTC machine can be useful for final cut of big bulk in an orthodox factory. It is recommended that any working machinery from this line be stored until a decision is reached about installation of an orthodox line.
6. Delivery of fertilizer late adversely affects yield, and application during rains wastes fertilizer due to its leaching beyond root depth. It is recommended that OCIR-The hold a strategic stock of 12 months supply of compound and selected straight fertilizers so that delivery of fertilizer to estates can be undertaken on time.

7. Foliar analysis (plant tissue analysis) should be undertaken three times per season (monitoring N, P, K, Mg, Fe, Cl, Zn, Mn, Ca, Cu, Na, B, S) to build up a Rwanda tea nutrition data bank, and that fertilizer application be made, after the fourth year, to maintain acceptable tissue levels of nutrients. This work should become the responsibility of the Rwanda Tea Research Institute. It can eventually be operated as a profit center.

3. BODY OF REPORT

3.1. What is orthodox tea?

Orthodox tea is rolled using eccentrically revolving rolling tables that mimic the action of traditional hand rolling, used to slowly disrupt cell integrity and to initiate fermentation. Orthodox rolling also breaks up and twists leaf to give visual style and blackness to the made tea – characters that are greatly sought after. The orthodox process is a batch process that permits great flexibility in its manipulation, and thus allows the tea maker to optimize his product depending on variations in raw material and in ambient conditions. Orthodox tea is noted for its liquor flavor rather than intensity of color: it is mainly drunk without milk. A typical orthodox line flow chart is shown in Appendix 3 - note however that this shows a simplified rolling program with two rolls; if leaf is of sufficiently good standard then up to four rolls may be used in some orthodox factories to maximize production of primary grades.

A flow diagram for orthodox green tea production (China parched leaf, and Japan steamed leaf) is shown in Appendix 4. Organoleptic characteristics of typical orthodox tea are noted in Table 1 below:

Table 1. Organoleptic character of typical orthodox style teas

Grades	Leaf Broken Fannings Dust
Leaf	Twisted or curled - can be stylish - can contain silver or golden tips
Liquor Appearance	Lighter color than CTC Clear red without milk Yellow / greenish hue with milk
Taste	Strong initial taste impact Usually combine strength & astringency High seasonal flavor is possible Often some origin specific flavors
Performance	Slower infusing Tightly rolled leaf locks in some solids Do not 'cream down' when cooled Long leaf can be brewed longer without bitterness Preferred by consumers that do not use milk Less liked by consumers that do use milk

CTC tea is manufactured as a continuous process and variations in the product are generally discouraged. CTC machines cut tea very finely (suitable for tea bags) and the almost instantaneous cell disruption leads to very rapid oxidation, often accompanied by exothermic heating. The process favors the production of liquor color and thickness, very suitable for fast infusing tea bags and the use of milk. A typical CTC line flow chart is shown in Appendix 5. Typical organoleptic characteristics of CTC tea are noted in Table 2.

Table 2. Organoleptic character of typical CTC style teas

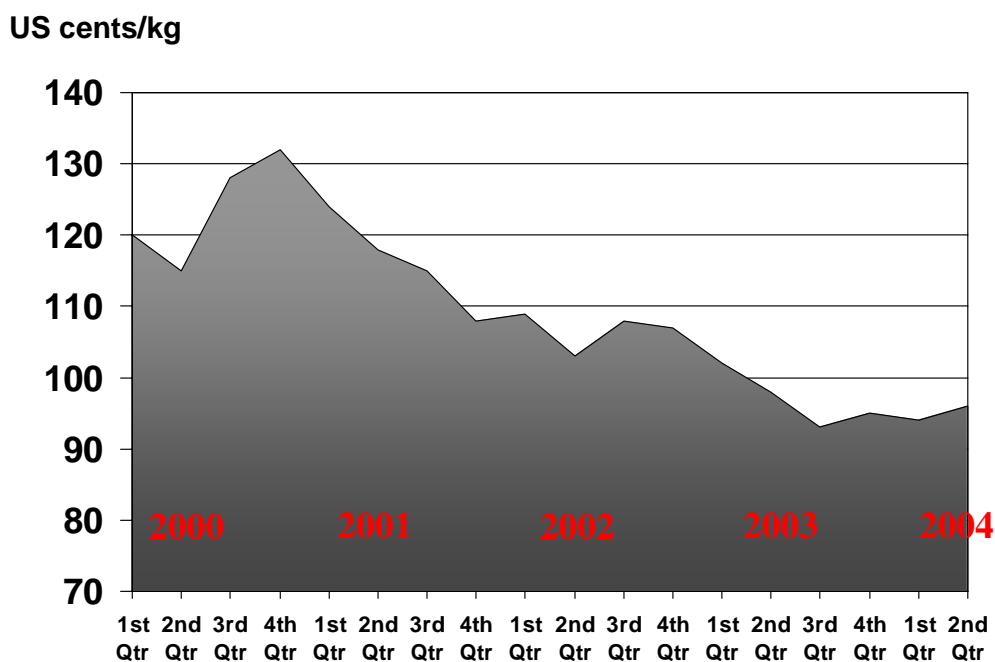
Grades	Brokens Fannings Dust
Leaf	Granular
Liquor appearance	Good depth of color without milk Golden / reddish color with milk
Taste	Good thickness and mouthfeel Rounded and smooth, some with briskness Less flavor than Orthodox
Performance	Rapid color delivery High level of soluble solids on leaf surface More suitable for teabag users Preferred by consumers that use milk Can be too thick for some markets

3.2. Why produce orthodox tea?

The market for CTC teas is depressed with more being produced each year than is consumed. Newer producing countries have entered the global market with large amounts of inferior tea – Vietnam for example quadrupled its tea exports between 1995 (18,000 tonnes) and 2002 (74,812 tonnes). Argentina too steadily increases its production of low priced low quality teas, sold at an average of US\$ 0.57/kg in 2003 (ref.9).

Prices remain dull across the tea world, having fallen overall some 35% since 2000. See the four auction centres (Mombasa, Calcutta, Colombo, and Jakarta) average tea price shown in Figure 1:

Figure 1. Average price trend of all teas sold at the four main auction centers



Orthodox tea is, however, generally in short supply and prices have held up better. Good quality orthodox teas have escaped the dull market and are selling at ever increasing prices into the burgeoning specialty tea markets of USA, northern Europe, and Japan – see also Section 4.3.1 below.

3.3. The specialty tea market

Specialty, or premium tea has been defined by Sage Group International (ref.2) as:

"higher quality long leaf teas with limited annual production, manufactured using orthodox methods. Commonly include unflavored black, green, oolong, and white teas from smaller tea producing regions or estates. Also referred to, particularly in USA, as Premium Teas and Gourmet Teas".

Specialty teas are a niche market, but a rapidly growing and high priced niche market. While specialty tea markets are fast opening up in Japan, South East Asia, and northern Europe it is northern America that is leading the way. Sage Group, in ref.6, believes that the rise in American consumption of specialty tea from 1990-2004 represents more than the evolution of a new beverage segment, but rather the birth of a new demographic segment – a loyal tea consuming community thriving on a complex fusion of diverse global cultures and flavor preferences.

The new American tea culture places high value on stress reduction (perhaps partially attributable to the relaxing properties of teas' own amino acid L-theanine), product purity (Fair Trade and certified organic tea is thriving in the US), and exotic brewing accessories (the after market for tea accoutrements is large compared with coffee based drinks).

The retail tea market in the USA is currently expanding at 15% (year on year) and topped US\$ 5 billion in 2003, of which US\$ 1.1 billion was in the specialty tea sector (ref.2) see projection to Year 2010 in Appendix 6.

Many of the high value specialty teas that are purchased at origin to meet the demand for the very varied types and formats of specialty tea are air freighted to bulk buyers and distributors, to ensure freshness and to be the first of the season. This excitement and interest in many ways mirrors the sailing clipper races of the nineteenth century that brought new season China teas into London. Air freight of a typically sized consignment of 750 kg of specialty orthodox tea from Kigali to New York would cost US\$ 4.87 per kg (see Appendix 7) – this would be considered an acceptable cost when selling on into a retail market that may be pricing teas at US\$ 50 per kg (see below).

3.3.1. Prices

Prices obtained by good orthodox teas exceed those realized for good CTCs. Table 3 shows prices obtained in the Calcutta Auction on 27-28 September 2004 – these are typical. Calcutta trades in rupees, prices are quoted below in US\$ per kg, converted at \$1 = Rs 45.68

Table 3. Comparative prices CTC and Orthodox teas at Calcutta auction.

Type	CTC Broken	O'dox Leaf
Best Assam	2.10 - 2.76	7.66 – 10.40
Good Assam	1.75 – 2.01	2.41 – 3.28
Med. Assam	1.53 – 1.70	1.97 – 2.19

Over the entire auction only 7% of CTC teas (all grades) achieved more than \$2.00 per kg, whereas 48% of orthodox teas (all grades) managed to exceed this price.

Even in quality seasons CTC teas will virtually never top \$3 per kg at auction, while orthodox teas can trade at very high prices, driven by supply and the quest for the unusual. Appendix 8 shows a recent news report (20 October 2004) from India recognizing that their low level of orthodox tea production (10%) is hampering tea exports.

Ex factory prices for Kenya black orthodox tea, for example, vary from US\$ 4.00 (KTDA) to US\$ 7.75 (Finlays – ref.1). Simpson & Vale of New York, a specialty tea retailer, sells Finlays’ Milima at US\$ 52 per kg, and KTDA Keteada at US\$ 65 per kg. The cost of importing tea into the USA (by sea) is around \$3 per kg giving a landed price of from \$7 to 10 per kg. Average mark up is 70 to 80% at each distribution stage – importer sells to distributor at around \$18-20 per kg; distributor to retailer at around \$30-35 per kg, and retailer to customer at around \$55-65 per kg. It is particularly advantageous to producer suppliers of specialty teas if they develop direct relationships with higher links in the selling chain; in this way the very high mark up can be shared between the producer and seller. This can be a profitable relationship but, in return the producer must maintain very strict product quality specifications, and provide excellent terms of service and timing and communication. KTDA failed to grasp this concept and have not (yet) been able to progress beyond selling their orthodox tea at a basic price to an overseas based importer.

3.3.2. Experience of other countries

Many countries that have flirted with CTC manufacture are reassessing their position. Sri Lanka had a program in the late 1980s of introduction of CTC; this reached 10% of production and is now declining. Average orthodox prices are US\$ 2 per kg with premium teas selling at US\$ 5 per kg. Kilburn, a particularly cleverly promoted specialty orthodox Ceylon tea (see Appendix 12) is being sold at an amazing US\$ 1,250 per kg¹.

India regrets having lost so much of its orthodox capability to CTC - “our product mix is skewed in favor of CTC tea, whereas the global demand is for orthodox teas” (see Appendix 8). Typical prices for good single estate orthodox teas in Assam can be US\$ 4 to 8 per kg.

In Nepal it is the mountain grown orthodox teas that find good prices, while the low grown CTCs struggle for sales. Though similar in character Nepalese orthodox teas sell below better known Darjeeling prices, at US\$ 2 to 8 per kg.

¹ This is a very good example of the extraordinary power of marketing (“turning an Oriental fable into a reality”) to add perceived value to a specialty tea. Other examples are the bespoke “frost teas” of the South Indian Niligiris, and the exclusive hand made sun dried teas of Georgia.

In Kenya, Finlays maintain production of specialty black orthodox from what until 2003 was the only orthodox line in CTC dominated Africa. Now they are joined by KTDA with black, green and flavored orthodox capability. These Kenyan Orthodox teas sell ex factory for US\$ 4 to 7 per kg

3.3.3. Types of orthodox tea

Specialty orthodox teas vary greatly in size, shape, style, color and taste.

Variations occur due to:

1. Leaf raw material type – from small leaved *Camellia sinensis*, or the fleshy leaved *Camellia assamica* types, or from the multitudinous hybrids between them. Clonal teas selected and propagated by cuttings help to “fix” desired raw material characteristics.
2. Pluck standard – some of the finest (and most expensive) orthodox teas are made from just the bud. Others are made from flush picked as one leaf and a bud. The majority are made from two leaves and a bud.
3. Plucking time – green teas are best made with very early morning plucking (with the dew on the leaves). Oolongs are best made with mid day plucking.
4. Withering greatly affects leaf style, color and taste. A Darjeeling or Nepal appears almost green, with silver tip. This results from a very hard wither and hence a light ferment. No juice is expressed so the tips remain silver. Golden tips in a malty Assam result from a soft wither – juice coats the tips to give them a golden color, and the leaf to make it black after firing.
5. Rolling technique affects leaf style and leaf size. Heavy pressure breaks up the leaf; long rolling gives a tight twist. Rolling technique, leaf quality and wither hardness are highly interdependent.
6. Drying temperature and duration can affect final taste and can enhance origin specific aromas.
7. Process manipulation that can result in white, yellow, green, oolong, and black teas.

3.3.4. Flexible manufacture - dual line

In many industries that produce consumer products, rather than commodities, it is becoming recognized that flexible manufacture is a prudent policy. The ability to react swiftly to changes in consumer demand and to quickly alter the type of product being made provides the flexible producer with a competitive edge. A dual line tea factory, with both CTC and orthodox machinery, and the process capability of making black and green teas, and perhaps some exotics like white and yellow teas, pure and flavored teas, gives a wide range and fast response to customer demands.

Ironically, dual lines were a common feature in African tea factories thirty years ago, as orthodox machinery was phased out in favor of CTC. The orthodox machinery was utilized when particularly good quality leaf was available. AHP (now Finlay) retained a small orthodox line at Saosa (Kenya - west of Rift) where they now produce some orthodox black tea to order. This was for many years the only African orthodox tea available, selling into the specialty market under the names Marinyam and Milima. In 2003 Tea Technology Associates installed an orthodox line (black, green and flavored tea) for the Kenya Tea Development Agency (KTDA) – east of Rift at Kangaita CTC Factory, selling mainly under the name Keteada. This was part of a two year tea value addition consultancy.

3.3.5. Machinery required for orthodox

Orthodox tea machinery is now only manufactured in India and Sri Lanka, but is still readily available to order. The design is very traditional and can be traced back to British development of this style of manufacture early in the last century.

The capacity of the smallest practicable orthodox line is 400 - 500 tonnes per annum (used on a two shift pattern). This equates to 200 kg of made tea per hour.

The basic machinery required is:

Withering troughs with individual radiators	x 8
Rolling tables	x 4
Roll breakers	x 2
Rotorvane 8" diameter	x 1
Fermenting trolleys	x 30
Fermenting trays	x 10
Wall humidifiers	x 3
ECP tray dryer with 3 circuits & radiator	x 1
Myddleton sorter	x 1
Macintosh sorter	x 1
Trinick sorter	x 1
Algaier sorter	x 1

Rolling tables are used in sequence, and are generally specified in sizes to accommodate varying loads as bulks are reduced. Sizes are chosen when a draft rolling program has been agreed. Tables can be smooth finished or with battens, and table centers can be with asymmetric well or with a raised cone of various designs. Table finish is chosen to enhance the style of leaf that is required to be produced. Rolling is generally undertaken for 20-30 minute periods, punctuated by roll breaking.

The **roll breaker and sifter** is used to break apart the rolled mass, and to sift out the detached particles (fines) that are then sent to ferment. The bulk that passes over the sifter is sent for another roll, under increased pressure. Meshes may be chosen to suit leaf standard, and intended market

When all the usable fines have been extracted (after 2 to 5 rolls) the remaining big bulk, containing mainly stalk and harder leaf, is sent for fermenting and drying. It may be cut first using a **rotorvane**, or even a single cut CTC, rather than broken after drying.

Fermentation of fines is best done in thin layers for “first fines” – extracted from the first roll. Subsequent fines can be fermented in GWA trolleys. Fines are kept separate through the dryer. Fermentation of orthodox tea is very long by CTC standards. It is timed from the beginning of the first roll, and depending on the temperature and pressure used, can be from 3 to 4 hours duration.

An **ECP tray dryer** is used for orthodox tea. While a FBD can handle orthodox broken grades it is not suitable for bulky leaf grades. Orthodox teas tend to lose blackness in a FBD, and fines cannot be kept separate as they can in a tray dryer. Generally a three circuit dryer is preferred, with steam radiator air heating. The dryer should be specified with trays perforations suitable for orthodox, and with an infinitely variable gearbox (not step change pulleys).

Post drying sorting equipment is different for orthodox teas. While the choice of equipment is somewhat dependent on the market, it is prudent to have available a **Myddleton** pre-sorter, a **Macintosh** reciprocal tray sorter, a **Trinick** fast action reciprocal tray sorter with fiber extraction rolls, and an **Algaier** rotary sifter. If red leaf stalk proves to be a problem then an optical sorter may be required.

It will be appreciated that, unlike the CTC process, an orthodox tea is partially sorted before drying – this reduces post dryer sorting and allows retention of maximum blackness. Whereas CTC sorting is a fixed pathway, the orthodox sorting sequence is constantly under review by the Tea Maker, who will change machines and mesh sizes to enhance the style and value of the ex dryer teas available to him on any day.

3.3.6. Investment cost

Machinery purchase price for a 500 tonne per annum black tea orthodox line will be approximately **US\$ 275,000**, assuming that the factory has sufficient steam available from its existing boiler. Additional items (steamer x 1, rotary intermediate dryer x 1, rotary drum tumbler x 1) to upgrade the line for green tea and flavored tea production would add an extra **US\$ 75,000**.

At Gisovu there will be some cost involved for moving machinery, altering partition walls and provision of green leaf conveyors from withering loft – allow **US\$ 30,000 - 50,000** for these alterations.

At Kitabi the CTC factory has little usable space available within the building, but a rear courtyard can be converted by roofing in between two buildings – estimated cost between **US\$ 70,000 - 90,000**.

Technical consultancy and training costs should also be considered – allow **US\$ 75,000** for consultancy (3 months total ex UK) and **US\$ 25,000** for training (3 months total ex India or Sri Lanka).

Total investment cost is very similar for both factories to include black tea, green tea and flavored tea options - **Gisovu US\$ 480,000 to 500,000**, and **Kitabi US\$ 520,000 to 540,000**.

Machinery should be selected from a range of suppliers and best prices negotiated, or if required a tender document written. Sourcing of equipment, and obtaining offers against final specification of machinery should be the responsibility of a project consultant, working with the client (OCIR-Thé or private investor).

3.3.7. Costs and returns

The typical average cost of production (CoP) of CTC teas around the world is currently US\$ 0.80 to 1.20 per kg. The higher figure is probable for Rwanda.

Premium orthodox tea CoP is higher than CTC as it is a batch process, and requires higher skill levels – allow US\$ 1.60 per kg.

The typical ex factory selling price for good East African CTC teas ranges from US\$1.20 to 2.50. Rwandan CTC teas are currently (November 11th Auction No.45) selling at US\$ 1.40 to 2.40 delivered Mombasa.

Premium orthodox teas in Assam and Sri Lanka, of the type and style expected to be made in Rwanda, sell from US\$ 4 to 10 per kg. CTC teas never reach these elevated prices, regardless of quality.

Table 4 shows the margin available in Rwanda from the production of 1,800 tonnes per annum of orthodox tea compared with a similar production of CTC tea. This quantity is chosen as an example as it is the amount of orthodox tea called for in the Rwanda National Tea Plan – orthodox black tea at 5% of 39,000 tonnes.

Table 4. Potential Return from Specialty Orthodox Tea Production

	For 1,800 tonnes black CTC Tea	For 1,800 tonnes black Orthodox Tea
Cost of Production CTC @ \$ 1.20 per kg ODX @ \$ 1.60 per kg	\$ 2.16 million	\$ 2.88 million
Selling Price CTC @ \$ 2.00 per kg ODX @ \$ 4.00 per kg	\$ 3.60 million	\$ 7.20 million
MARGIN	\$ 1.44 million	\$ 4.32 million

To meet a target production of 1,800 tonnes per annum will require a total of four lines of orthodox machinery, and will also require increased yields in line with the Nation Tea Strategy – see Section 6.5.1. When achieved, and it could readily be achieved in five years, the increased margin of US\$ 2.88 million per annum for orthodox manufacture (\$ 4.32m less 1.44m) will be generated from a capital investment of approximately US\$ 2 million – a very attractive cost benefit.

3.3.8. Manpower and training required

After installation of machinery (responsibility of the supplier) and satisfactory commissioning (joint responsibility of supplier and project consultant) it will be handed over to the client. Selection and training of machine operators then commences. An established Orthodox manufacture line must be manned separately from CTC manufacture, with its own workforce who will be trained on the job to accumulate the expertise required for this very different type of manufacture. Initial training of staff and labor will be of the “hands on” type led by project consultants and visiting technical experts. After a period of six to nine months it may be appropriate for the Production Manager to visit orthodox manufacture facilities in India or Sri Lanka to extend his understanding.

From experience gained at KTDA the basic orthodox training process requires about three months, during which time some saleable product will be produced.

Orthodox Production Manager	x 1
Assistant Manager Production	x 1
Assistant Manager QC	x 1

In addition to the Assistant Manager Production acting as Orthodox Tea Maker the labor required, per shift is:

Process supervisor	x 2
Withering	x 2
Rolling	x 6
Fermenting	x 2
Drying	x 2
Sorting	x 6
Mechanic	x 1

Two shift working will require an increase in labor but not of other grades. It is important for the shift team to be flexible and capable of some degree of job sharing.

4. RWANDAN TEA INDUSTRY

4.1. Specialty tea strategy for Rwanda

The ontheFRONTIER tea strategy (National Tea Cluster Objectives, Scenario II) prepared as part of the Rwanda Competitiveness and Innovation Program (ref.1) was ratified by the Council of Ministers on 20 October 2004. This strategy repositions the Rwandan tea industry with strong growth (100% increase in seven years) and diversification from hitherto 100% bulk CTC tea to a mix of 75% CTC, plus 13% flavored tea, 6% green tea, 5% orthodox tea, and 1% organic tea. Some 23% of tea exports will be pre-packaged. It requires a yield increase in the period from 1,431 kg/ha to 2,400 kg/ha, and predicts export earnings growth from US\$26.8 million to US\$91.0 million. It envisages a key role for private investors.

4.2. OCIR-Thé

Since 1964 OCIR-Thé have headed up the parastatal production of tea with responsibility for promotion of the tea sector, its management and expansion, and selling of CTC tea through the Mombasa auction. OCIR-Thé have operated during this time under the Ministry of Agriculture but a change has been announced with transfer of OCIR-Café and OCIR-Thé to the Ministry of Commerce, Industry and Tourism. Privatization of the ten OCIR-Thé tea factories, though it commenced in 1996 has not proceeded as swiftly as was envisaged. To date Sorwathé, in which OCIR-Thé had a 23.54% share, has become wholly privately owned (2003), and 55% of Government shares in Pfunda have been sold to London based LAB International for US\$ 1.06 million (2004). Bids for Mulindi did not meet the asset valuation figure and the invitation was withdrawn.

The next tranche of OCIR-Thé factories scheduled for privatization are Mata, Kitabi, Gisakura and Shagasha in 2004, though this again appears to have fallen behind schedule.

4.3. ADAR

The USAID funded project for Assistance à la Dynamisation de l'Agribusiness au Rwanda (ADAR) is set up to assist in adding value to the Rwandan agricultural sector. It seeks to help clients increase profitability and profit, improve product quality, and give better access to financing and marketing. Emphasis has been placed on products for export, horticulture, pyrethrum, ornamental flowers, food processing and tea.

With the adoption by Government of the National Tea Strategy based on diversification and adding value, and as privatization of tea estates occurs and OCIR-Thé comes to terms with its new coordinating and generic marketing role, ADAR will have an increasingly important part to play in skills development, training, ensuring that the right information is freely available, and co-ordination - making sure that all tea industry stakeholders are heading in the same direction.

4.4. Benchmarks

Orthodox tea production takes place mainly in Sri Lanka, China, Indonesia, Japan and India. The Rwandan tea industry is geographically remote from any example of orthodox production. Tea industry stakeholders – OCIR-Thé personnel and potential private investors have little idea about the techniques or benefits of orthodox tea manufacture, nor much information about how tea estates and factories are run in other countries. The concept of using selected competing industries as a benchmark to measure one's own development is not new, but it is a most effective tool.

Sri Lanka orthodox factories. It is recommended that arrangements should be made for a group of Rwandan tea industry stakeholders to take a trip to Sri Lanka to inspect all aspects of orthodox tea manufacture, retail packing and marketing. Tea Technology Associates arranged a similar tour in 2003 for twelve stakeholders in the Georgian tea industry. This trip was found to be both instructive and motivational (see Appendix 2 for itinerary).

Further suitable benchmarks that should be considered by OCIR-Thé and private investors are:

Sorwathé S.A.R.L. The previously part private company that is now wholly privately owned. This factory is a very good example of what can be done within the constraints of operating in Rwanda. Fuel trees are well managed, yield is acceptably high, transport damage has been tackled, the tea room is well equipped with QC instruments, process machinery is appropriate to modern CTC manufacture, space is intensively used, manpower saving devices are operated (monorails, wheeled bins, conveyors), machinery has been modified and converted to optimize its performance, modern management techniques (for example computer aided wither management) have been introduced, novel products have been attempted, some sales are made in value added format, vacuum packing of bulk tea is practiced, direct selling of tea to a leading UK packer is undertaken.

KTDA Kangaita Tea Factory. A modern orthodox tea line installed and commissioned in Kenya in 2003 as a dual line in a CTC factory (the first new orthodox tea line to be installed in Africa for 50 years). Operators were taken from CTC manufacture and trained in the orthodox technique. This line includes black orthodox, steamed green tea orthodox, and flavored tea capability. Orthodox tea in ten primary grades and four off grades was originally produced, though this has now been reduced to eight primary grades. Kangaita orthodox teas have been sold to USA, UK, Japan, Germany, and central Europe. Some OCIR-Thé personnel have already visited this factory.

4.5. Tea opportunities

Box 1. lists 47 added value tea opportunities for Rwanda. Direct selling opens up a full range of product and marketing opportunities that selling at auction cannot offer. Taking advantage of these opportunities requires that new skills are learned; market research, product development, materials science, quality assurance, packaging engineering, consumer trialing, direct selling, and export logistics.

4.6. Agro tourism

Many countries are investing in agro-tourism and eco-tourism, offering tours and informational visitor centers demonstrating the production of a variety of crops that many tourists will only know from their local supermarket. In Hawaii, coffee, sugar and guava growing is well represented in the agro-tourism sector. These facilities are well attended by holiday makers, and the Kauai Coffee visitor centre, as an example, has brisk retail sales of products and related material even out of season. Tea agro-tourism is a growing phenomenon around the world, and there are many examples of far sighted tea plantations in Australia, Malaysia, Sri Lanka, Darjeeling, Thailand and Indonesia taking advantage of the opportunities (see Appendix 9). For Rwanda, combining the undoubtedly scenic aspects of tea estates with the educative aspects of tea production can be a boost both to the tea sector and to the tourist sector. This can cover the range from tour parties by bus to high quality “away from it all” accommodation offered on remote and picturesque tea estates, with helicopter transfer from Kigali. Estate tours, factory tea shops retail sales, product sales through other tourist outlets (airport² and hotel gift shops), and sales to local restaurants will all be important to initial agro-tourism marketing.

² It was noted that Sorwathé has gift packed cartons of their black, green and oolong teas on sale at Kigali International Airport duty free shop.

4.7. Local tea sale

On the Frontier includes domestic market sales in the national tea strategy. This is an important potential market and should not be neglected. Certainly, as prosperity grows and disposable income allows more Rwandans to buy tea and the milk and sugar that is considered essential for enjoying tea, the market demand will increase. If local entrepreneurs are not ready to supply this requirement then it will be supplied by importing tea. Imported tea already accounts for 60% of local sales, with teas from Burundi, Kenya, Tanzania, Uganda, and UK to be found in the Rwandan market (ref.1).

Box 1. Portfolio of Tea Added Value Opportunities for Rwanda

Tea formats

- Specialty tea orthodox black x range of grades
- Specialty tea orthodox green x range of grades
- Specialty tea orthodox oolong x range of grades
- Specialty tea orthodox white x range of grades
- Specialty CTCs
- Flavored teas – orthodox black x range of flavors
- Flavored teas – orthodox green x range of flavors
- Iced tea mixes – off-grades x range of flavors
- Local herb mixes with black tea
- Local herb mixes with green tea
- Black tea pre-blends – CTC

Product formats

- Loose in bulk 4 ply paper sacks 40-50 kg
- Loose in mini sacks 4 ply paper x range of sizes
- Loose in bulk in lined board cartons 25-40 kg
- Loose in lined mini cartons 3-10 kg
- Loose in foil laminate pouch in retail carton
- Loose in heat sealed paper in retail carton
- Loose in foil laminate pouch in gable carton
- Loose in flow fill foil laminate block bottom pouch
- Loose in drum
- Loose in tin
- Loose in wood chest
- Tea bags – S&T
- Tea bags – S&T teapot size
- Tea bags – S&T and envelope
- Tea bags – heat seal square
- Tea bags – heat seal round
- Tea bags – heat seal tea pot bags
- Gift packed – in tin
- Gift packed – in chest
- Gift packed – in handicraft cloth bag
- Gift packed – in handicraft woven bag
- Vacuum packing of bulk packs
- Vacuum packing of retail packs
- RTD teas

Marketing Opportunities

- Bulk sales to distributors
- Bulk and packed sales via food brokers
- Web sales
- Mail order sales
- Local wholesale
- Tourist outlets
- Hotels and restaurants
- Factory door sales
- Toll packing to sell through own label outlets
- Toll packing to sell to institutional outlets
- Packing under own brand – stores and specialty outlets
- Packing imported specialty teas for stores and specialty outlets

4.8. Research and development

No major tea country and very few minor ones exist without a tea research station. There is an urgent need in Rwanda for a tea research station with an initial remit to select clones for local conditions and to suit product requirements, undertake fertilizer trials under local conditions, adapt husbandry and plucking methods to local conditions, to trial new methods, and evaluate new machinery. Basic science and technology is applied to industry problems and commercial companies take up and develop specific applications. Exchange visits undertaken between international research stations extend knowledge and maintain standards. International publication of research findings and attendance at international seminars acts to promote and make known the excellence of Rwandan tea.

4.9. Product development

Product development is not an activity that is required for the traditional production of commodity tea for sale at auction; however, it is a vital tool when tea is considered as a consumer product. Product development is a systemized procedure that creates and optimizes products to match consumer requirements. As Rwanda moves towards a diversified and added value tea industry there will be a fast growing need for product innovation and development. The responsibility for this work will eventually fall to the commercial companies, but at least initially, there must be active encouragement and a practical lead shown by the Government through OCIR-Thé or by setting up a dedicated Rwanda Tea Development Institute. In Sri Lanka the tea research institute (TRI Talawakelle) performs a similar role, heading up generic work in tea product innovation, tea instantizing, tea concentrates, RTD tea bottling. It also has experimental processing facilities that may be rented by private companies.

4.10. Market development

As shown in Section 4.3.7 there is clearly a very large cost benefit available from investment in orthodox tea production if this is directed at the fast growing premium specialty tea market. However, such high returns do not come without an effective and skilful marketing program.

Selling tea at the auction is not marketing – but is the only method that OCIR-Thé knows. To be profitable tea has increasingly to be sold by direct selling methods. Sorwathé has discovered this and has become a technical audited and certified direct supplier to Premier brands of UK. Sorwathé has added value to these direct supplies: it vacuum packs bulk teas supplied to Premier (for freshness), and pre-blends them to Premier specified teabag packing standards. This type of relationship gives supplier/customer continuity that the auction can never offer.

Finding customers for premium orthodox teas requires detailed knowledge of global tea trends, understanding of consumers' habits and requirements, good relationships with international buyers, wholesalers, and distributors, skills in exporting and distribution chain management, and perhaps most importantly a high profile as a producer of quality teas – all this is unknown territory for the Rwandan tea industry..

There is an important role for the Government of Rwanda (through OCIR-Thé or through a National Tea Board) for generic promotion of Rwandan tea. Generic promotion is not the sphere of the private producer but if correctly undertaken the commercial companies will follow, advertising and promoting their teas under the generic umbrella. Without this assistance their efforts will not be seen or heard internationally. Successful added value tea countries have realized this and acted accordingly through their Tea Boards.

Generic promotion includes:

- Raising awareness overseas through press advertising
- Production of brochures and videos
- Setting up an informative and attractive web presence
- Maintaining tea QC standards for export
- Acting as an export intelligence hub
- Assisting local producers to attend international trade shows
- Helping local producers to visit other tea producing countries
- Hosting visits of tea producers and packers from other countries
- Holding international tea meetings in Rwanda
- Ensuring that Rwanda is seen as a Center for Excellence in Tea Production³

Specific market promotion activities for private producers includes:

- Coordinating with the generic promotion.
- Making contact with international customers.

³ An essential part of ensuring that Rwanda is respected as Center for Excellence in Tea Production is that local production matches best practice around the world. There is a central organizational role here for a standards body (public-private cooperation) to benchmark Rwandan factories and ensure that they truly are excellent. Setting up of a Rwanda Tea Development Factory that can test, evaluate and demonstrate best and latest practices may also be a useful Government role.

- Constantly extending customer base.
- Following tea trends and new opportunities.
- Allocating sufficient funds for full and effective sampling .
- Acting in a timely manner.
- Ensuring that paperwork is correct in every detail.
- Effectively communicating with customers, particularly when things go wrong .
- Never promising more than can be achieved.
- Ensuring that agreed specifications can be met.
- Setting up QC facilities for checking and maintaining specifications .
- Attending international trade shows and meetings.
- Doing nothing to detract from the image of Rwanda as a center for Excellence in Tea Production.

Without a modern marketing strategy, premium orthodox tea production in Rwanda will be a high risk venture – as the saying goes “if you can’t sell it, why make it?”. Premium tea must be sold at high price into niche markets internationally. Investor risk can be minimized by application of well established marketing methods developed for high value consumer goods. The “middleman cut” that so much reduces value received by the producer can be reduced by entering higher up the distribution chain. Tea entrepreneurs (for example Dilmah of Sri Lanka) that pack and promote their own brand directly to retailers retain a larger proportion of the margin. Producers who are fully vertically integrated and sell to end users retain the whole margin – this is increasingly occurring where tea producers sell by mail order through their own Internet web site.

It may be noted here that the first venture of KTDA (Kenya Tea Development Agency) into value added orthodox tea production was a technical success, but lack of marketing skill (and lack of real understanding of its importance) has hampered success of their venture as a whole.

5. TECHNICAL APPENDIX

5.1. Factories studied – Orthodox tea feasibility

The two nominated factories – Gisovu and Kitabi, were assessed for their suitability for installation of an orthodox tea line as a dual manufacture adjunct to current CTC production.

5.1.1. Gisovu

5.1.1.1. Field overall

The Blocs Industriels (BI) fields are well tended, although (in October) they were at the end of the dry season with some blocks being adversely affected by frost and hail, and some clones (drought sensitive TRI 6/8 in particular) not flushing due to lack of rain. Nevertheless the bushes looked in good heart and the estate appeared tidy and well cared for. Weeds were under control, wind break hedges mainly in good condition; estate earth roads were in fair condition.

Plucking is carried out by the gang plucking method with one captain and a team of 30 pluckers returning to the same field for each plucking round of 10 to 11 days. An incentive system is applied during heavy crop months.

The program scheme plucking method (PSP) pioneered in the 1980s by TRFCA in Malawi (ref.7) and rapidly taken up by Kenya tea multinationals should be trialed in Rwanda as it encourages good selective plucking, reduces coarse leaf plucked, reduces absenteeism, and improves overall yield.

5.1.1.2. Field observations

Gisovu has the potential to produce very high quality orthodox tea. It is situated at a high altitude close to the equator, soil is ideal for quality, it has a good mixture of clones that, while selected for CTC production, will translate well to Orthodox style, and will allow manufacture to be optimized to achieve the best quality from each.

Pluck standard is good; both in BI and TV (Thé Villageois) plantings, but delivered leaf quality is spoilt by damage incurred during transport to the factory. This damage is present both as crushed leaf and overheated leaf, and is primarily due to overloading of trucks. This can be solved by use of a rigid stacking collection box system – as used on quality estates in Sri Lanka and South Africa, or a truck mounted hanging rack system as used by KTDA in Kenya.

Given the required improvement in transportation there would be an immediate increase in leaf standard to the required quality for orthodox manufacture without any significant change in plucking methods in the field. Applied overall, the improvements in transport of leaf would benefit CTC manufacture as well as enabling orthodox manufacture.

General findings are highlighted with respect to their suitability for orthodox production:

1. The leaf standard is medium quality and has the potential to be much better. Premium orthodox manufacture requires leaf of 80-85% standard. Fine leaf percentage is currently running at 69-72% from both TV and BI. In the best leaf quality season (March to June) they expect 78-80% from BI and 73-74% from TV. In the worse quality season (July to September) TV bring leaf in at 66% while BI achieves 70%.
2. Leaf standard is being reduced in two ways: by hail damage – this is temporary and cannot be avoided, and by crushing of leaf during transport – this can be avoided by better management and incentives.
3. Crushing damage is caused by overloading leaf transport trucks allowing leaf at the bottom to be crushed and to overheat. This type of damage will reduce CTC made tea value (browning of the dry tea and lower brightness and body in the liquor) due to loss of substrates and to premature fermentation. For orthodox tea the crushing will also spoil the style of the made tea leaf, and heating will reduce the desirable blackness of the leaf.
4. Transporting in small trucks loaded with in excess of 2,500 kg of green leaf stacked in bags – and often with two men riding on the top – cannot give a quality product. While this is not supposed to happen it does frequently. Two methods that have been evolved for high quality transport are a) the use of rigid stacking plastic crates (e.g. some estates in Sri Lanka) and b) the use of trucks with a hanging frame to ensure that no sack has any pressure exerted upon it (e.g. KTDA in Kenya).
5. When crushing damage is eliminated by proper transportation then there will be an immediate improvement in fine leaf percentage without any change in plucking technique in the field. With this improvement in place the leaf standard will approach suitability for orthodox tea production.
6. If OCIR-Thé is serious about quality in the factory, then they must first solve the problem of quality destruction during transport.

7. Gisovu has a wide selection of clones planted in separate blocks. While this is not ideal for CTC manufacture, it is certainly preferred for specialty tea production as it allows the tea maker to optimize orthodox procedure for specific clones and to maximize tea value from day to day.

5.1.1.3. Factory overall

Gisovu is a small standard design CTC manufacture factory with forty troughs, green leaf vibro sifter, one working CTC line (36" quadruplex) fed through 15" rotorvane, fermenting in GWA tubs, wood fired steam boiler, FBD dryer, fiber extractors, vibroscreen and Trinick sorter, Java tunnel winnower, and 30 bulk bins for grade storage. Troughs are heated by ducted air from two old wood fired air tube stoves.

There were two ECP dual circuit dryers originally installed, one of which is removed, and the other now obsolete is planned to be removed soon. One 24" CTC line, including two jumbo units, is also obsolete and will also be removed. Note however that a single cut CTC machine can be useful for final cut of big bulk in an orthodox factory. **It is recommended that working machinery from this line be stored until a decision is reached about the installation of an orthodox line.**

There is unused space available within the factory building that could be utilized for an orthodox line. The total factory area is 6,867 m² arranged as shown in Appendix 10-1, of which 1,566 m² is not fully used. Lay out in Appendix 10-2 shows positioning of the 500 tonne capacity orthodox line using 938 m² of the available space. Utilizing this space will require some rearrangement of existing equipment and may mean moving some partition walls. It has been estimated at this stage that sufficient trough capacity is available to avoid building extra trough capacity for orthodox production, and that sufficient boiler capacity exists for one additional ECP dryer. At a later stage it would be prudent to install a second boiler as this is good insurance against break down.

5.1.1.4. Factory observations

To successfully introduce a dual line CTC and Orthodox system in Gisovu factory, at the same annual capacity (1,200 tonnes) there would need to be a slight increase in withering capacity (orthodox leaf requires a harder wither than CTC). However, to avoid the installation cost of extra troughs it is advised that orthodox tea production should be reduced in the two heaviest crop months (December and January) when quality would be poorest.

The factory also needs a change from central hot air production for wither to individual steam radiators on each trough, and a reorganization of process space. Overall there is approximately 1,500 m² floor area not fully utilized at present (out of a total 6,900 m²); this is sufficient for the proposed orthodox line. Any increase in the total installed capacity beyond 1,700 tonnes would require additional withering troughs, boiler capacity, and extra floor area.

1. Leaf reception is speedy with leaf bags transferred to troughs by monorail. Leaf QC is performed for each truck using a standard system based on visual analysis of a 100 gram sample. For TV leaf the QC is performed with a factory person and a Farmers' Association person present.
2. Troughs are loaded neatly and leaf is well fluffed during loading. In off season troughs are loaded to 800 kg, though this may be increased up to 1,200 kg during rains, as it is claimed that leaf intake exceeds trough capacity (though it is difficult to understand why this should be so – see Section 7.3.13 Withering). It is impossible to obtain a good even wither at this high loading.
3. Orthodox production requires a harder wither than is used for CTC. Gisovu still work to the traditional % moisture loss system rather than the modern (and more accurate) % moisture content system (which involves use of a moisture meter) – see Section 7.3.13 Withering. The factory moisture loss target is 70% which at an incoming Green Leaf (GL) moisture content of 80% is equivalent to a Withered Leaf (WL) moisture content of 72% (wet weight basis) - a very soft wither. For orthodox manufacture much harder withers are required at moisture contents of 50 to 65% (depending on style of leaf required). At a GL moisture content of 80% and using the % moisture loss system this is equivalent to withers of 40% (hard wither – like Sri Lanka orthodox) to 55% wither (soft wither – like Assam orthodox). In practical terms this means that up to twice as much water must be evaporated during withering; this requires withering troughs with effective heating systems and without overloading. Note that at a GL moisture content of 75% (dry season tea) then the evaporative load is reduced as a wither moisture content of 50% is then only a moisture loss of 50% (instead of 40%). It is due to this profound effect of field moisture on the correct withering target that the % moisture content system was introduced, and process consistency enhanced irrespective of season.

5.1.2. *Kitabi*

5.1.2.1. Field overall

Kitabi is at a very slightly lower elevation to Gisovu. The estate plantings are again, neat and orderly, despite the season and the ravages of frost. Blocs Industriels planting is at 350 hectares and Thé Villageois is at 650 hectares.

Kitabi has the same eight clones as Gisovu but these have been planted throughout the estate as mixtures, precluding the making of individual orthodox clonal teas. There is no significant BI space for future extension planting in pure clonal blocks, though TV farmers are still planting and could incorporate any newly acquired clones into single clone plantings.

Husbandry at Kitabi is slightly less traditional in style. Recovery from pruning is well ahead of Gisovu.

Leaf standard from is from 63-74%, this will needs slight improvement after leaf damage is eliminated to bring it to the necessary 80-85%. This can most easily be improved for green leaf from the BI. Kitabi could harvest sufficient green leaf for an orthodox line from BI plantings close to factory within 30-40 minutes transport time.

5.1.2.2. Field observations

In the field the fertilizer second split is overdue by a month. It has not been applied as it has not yet been delivered, nor has the remedial application of KCl been applied to cure potassium deficiency showing up on 50 ha of BI. The first split applied in January 2004 was actually the delayed application from September 2003 – delivered late and was never applied. Kitabi has a considerably better yield than Gisovu, but in the absence of foliar analysis data it is difficult to decide how much of this difference is due to fertilizer application tactics and how much to husbandry.

	Made tea yield kg/ha 2002 (ref.1)	Made tea yield kg/ha 2003 (factory own data)
Kitabi	1,273	1,436
Gisovu	992	1,188
Mata	900	890
Nshili Kivu	416	543

It is estimated that yields at all locations could be brought up to international standards if the proper inputs were given according to accepted principles. For hill grown tea this would give a ceiling yield of around 2,300 to 2,500 kg of made tea per hectare.

The published Kitabi conversion ratio of 4.02 kg Green Leaf to 1 kg Made Tea in 2001 (ref.4) points to severe problems with green leaf drying out during transport. It had improved to 4.14 in 2003, but this is still well outside the safe range of 4.25 to 4.35 (see Issues: Section 7.3.7 Conversion Ratios).

5.1.2.3. Factory overall

The factory is well run within the limitations imposed by old equipment and the poor supply of replacement parts and spares. These problems are ones that can only be solved centrally.

The factory is older than Gisovu and machinery is in slightly worse condition. Withering air circulation is certainly inferior to that of Gisovu, but Kitabi has the benefit of steam radiator withering troughs.

5.1.2.4. Factory observations

The factory does not have sufficient spare space internally to install a 500 tonne per annum orthodox tea line requiring a minimum area of 1,000 m². However, the factory is laid out logically and a courtyard exists between the withering building and the main processing area. If the orthodox production were sited there it could easily be fed with withered leaf from floor 1 of the withering building.

The existing steel frame of the two buildings could be utilized to add a roof across the courtyard, leaving a 3 m wide corridor alongside the wither building for ventilation. It is envisaged that orthodox rolling, roll breaking, fermenting and drying would be undertaken here, and orthodox sorting would be placed in part of the existing packing room.

Kitabi factory, modified as above would be very suitable for orthodox production.

The operational limitation of only having one working boiler (see Organization Section 7.1 Kitabi Factory) applies equally to Gisovu Factory.

5.2. Comparison of findings

Considering each factory's suitability for introduction of orthodox production:

Table 5. Comparison of suitability aspects of Gisovu and Kitabi factories for introduction of orthodox tea

Aspect	Gisovu	Kitabi
Planting material – in ground	Eight assamica type clones, planted in separate blocks, allowing production of optimized clonal teas	Eight assamica type clones but planted as mixtures, precluding making of individual clonal teas.
Planting material – new	No BI space for extension, though TV farmers are still planting and could incorporate new clones	No BI space for extension, though TV farmers are still planting and could incorporate new clones planted in separate clonal blocks
Division of planted area	BI 340 ha TV 732 ha	BI 350 TV 650
Altitude	2,400 m	2,150 m
Aspect	Hill tea 100%	Hill tea 100%
Control of green leaf	Can harvest sufficient for Orthodox line from BI plantings close to factory	Can harvest sufficient for Orthodox line from BI plantings close to factory
Fineness of leaf	Leaf standard from 66-80%	Leaf standard from 63-74%
Harvesting skill	Sufficient if leaf damage eliminated	Needs slight improvement after leaf damage is eliminated
Husbandry	Slightly more traditional	Slightly less traditional
Existing field yield	992 kg/ha (2002) – a very low yield	1,273 kg/ha (2002) – slightly better yield close to the country average.
Transport quality	Can be improved easily for green leaf from BI	Can be improved easily for green leaf from BI
Transport time	Can be within 30-40 minutes for orthodox BI green leaf	Can be within 30-40 minutes for orthodox BI green leaf
Factory space	Sufficient for installation of a 500 tonne orthodox line if some existing equipment is re-sited	Not sufficient for a 500 tonne orthodox line by re-siting equipment – but an easily converted area is available
Cost of installation	Minimal – resiting of equipment and services	Slightly more expensive – required roofing in of a courtyard
Existing GL conversion ratio	4.27 : 1 – excellent conformity with GMP (though has been out of range in the past)	4.02 : 1 – raises questions over transport standards.
Fuel trees	314 ha – just sufficient for planted area	580 ha – more than sufficient for planted area

For the purposes of the presentation given to stakeholders on 21 October 2004 all the sites visited were scored for potential suitability for orthodox production (including Mata and Nshili Kivu). Scores were based on the aspects listed in Table 5. Of a possible 100% suitability, Gisovu scored 73%, Kitabi scored 59%, Nshili Kivu (assuming a factory were built) scored 55%, Mata scored 41%, and KTDA Kangaita (Kenya) judged on the same criteria, scored 68%.

Aspects that scored against Kitabi were the mixing of clones in the field, and the low green leaf to made tea conversion ratio. For Gisovu to score higher than KTDA Kangaita – already successfully producing specialty orthodox tea, is particularly satisfying.

5.2.1. Implementation chronology

A suggested five year timeframe for the introduction of orthodox tea is given below in Table 6:

Table 6. Timeframe for introduction of orthodox tea within National Tea Strategy

YEAR	FIELD	O'DOX	CTC	MARKET
1	Fertilize with 150 units N, introduce foliar analysis Locate and import additional clones for orthodox, VP in nursery	Relocate machinery (G) Build new shell (K) order equipment	Make necessary repairs and maintenance, ensure all QC & sensors working. Continue production with emphasis on quality	Prepare market strategy for selling specialty orthodox tea. Look at direct sales opportunities for CTC
2	Fertilize with 250 units N Foliar analysis New clones to field. Continue to seek novel clones	Install & commission equipment, train operators, commence product development	Continue production with emphasis on quality Plan to update selected CTC lines	Commence market exposure with advance promotion at specialty tea trade shows, prepare brochure, video, etc
3	Fertilize with 350 units N Foliar analysis	Produce marketable products, extend product development	Install new CTC machinery	Commence serious selling of specialty orthodox. Consider toll packing of specialty teas including CTCs
4	Fertilize with 400 units N Foliar analysis	Expand o'dox production, sharpen expertise, introduce novel methods – oolong, white tea	Continue CTC manufacture, optimizing value	Expand specialty tea markets. Commence toll packing. Plan for specialty tea packing in Rwanda
5	Fertilize on replacement basis	Learn to exploit seasonal effects, clonal differences, plucking effects	Continue CTC manufacture, optimizing value	Install Rwanda tea blending and packing facility

Table 6 considers the introduction of orthodox tea within the context of the National Tea Strategy that requires in parallel a rapid increase in yield and in conventional CTC tea production. Initial production of orthodox tea could commence in Year 2; with full production in Year 3. The requirement for a strong generic marketing program must not be overlooked – this is an extremely necessary role for OCIR-Thé to play in the future; it cannot be left to private companies to fund and coordinate generic tea promotion.

If Rwanda is to be recognized as a producer of specialty teas and as a world center of tea excellence, then there must be a strong and effective marketing body promoting the interests of the Rwanda tea industry. This leading role has been well played by the Sri Lanka Tea Board and is key to the success of Sri Lanka in diversified and added value tea production.

5.3. Factories studied - Organization

Some of the organizational problems of Kitabi are highlighted below. They are further addressed in Section 7.3: General Issues.

5.3.1. Kitabi

1. Kitabi suffered from the long dry summer in 2002 with production down 21.5% on 2001, reaching only 79% of planned target (ref.11). The low yields achieved during dry seasons need special attention. Certainly better nutrition would prolong flushing into the dry season, and improved mulching could be tried. In many countries irrigation is used to extend the productive season – this may be worth a costing exercise in Rwanda to check its feasibility particularly for the BI plantings.
2. The green leaf conversion ratio was 4.03 in 2001, 4.07 in 2002, and 4.14 in 2003. This very low ratio (normal range 4.25 to 4.35) is a danger signal and can indicate intake of very coarse leaf, or more probably excessive drying out of green leaf before weighment. Notwithstanding very detailed records being provided to OCIR-Thé on a monthly and annual basis, it is surprising to find that such adverse conversion ratios at Kitabi and Mata have been ignored for so long.
3. Kitabi yield was 1,273 kg MT per hectare (in 2002) and 1,436 in 2003. This is 95% of the Rwanda average, and is the best yield achieved in Rwanda for mountain grown tea, though still only 43% of Sorwathé yield on swamp soil. It could undoubtedly be boosted to 2,300 to 2,500 kg/ha with proper inputs.
4. Kitabi has two nurseries for raising VP cuttings from clonal mother bushes. These are not as big as planned as the required materials were late in delivery. It improves on the position noted in the report of John Walton (ref.11) - a lack of a planting program and that small farmers were extension planting with harvested seed.
5. Planned nitrogen fertilizer application is at one third (100 kg N/ha) of an ideal level.

6. Logistically the main factory problem is that it has only one FBD (an ancient tray drier still in place does not work) and only one boiler (the spare boiler does not work). Thus in the event of dryer or boiler mechanical failure the whole factory ceases to function until it can be repaired.
7. Withering too is compromised. Fifteen of the 32 troughs are out of commission waiting for radiator replacements to arrive. There is significant leakage of steam and water in the withering building; this hampers accurate withering. There are other leaks and irregularities in the steam reticulation. This too awaits spares.
8. Add to this there are serious power problems – lack of grid power in this year to date is vastly increased from last year's 273 hours to 2,502 hours. Running the old standby diesel generators as a continuous prime source has shown up mechanical weaknesses in the aging equipment. One of the three generators is not working.
9. Kitabi had problems in 2003 with the production of over fired tea. This was due to problems with steam supply to the dryer, and to vibration fracture of the first stage cyclone. While such problems may occur in any factory from time to time it is most unwise to release teas for sale that are below specification. A reputation is very easily lost when buyers find teas being sold out of condition – it takes, as Kitabi is now finding, a very long time to regain a good quality reputation.

5.3.2. Mata

Some of the organizational problems of Mata are highlighted below. They are further addressed in Section 7.3: General Issues.

1. Actual tea production in 2002 (1,242 tonnes) was 78.5% of its expected production of 1,588 tonnes (though note that the installed capacity for Mata is nominally 1,200 tpa). For comment on planning see Issues Section 7.3.17 Planning.

Reasons given (ref.10) for the shortfall were :

- Dry season leaf was of rough quality
- Leaf from Nshili Kivu was overheated and damaged when delivered due to long transport (58 km over bad roads)
- Plucking manpower shortage during high production season
- Difficulties in managing TV plots that have been abandoned

- Fuel wood limitations – some has to be sourced from Kitabi and from third parties

Conversation with factory management confirms that fuel wood problems are being addressed, that there is now no problem with abandoned TV plots, and that an incentive scheme has begun to alleviate manpower shortage.

2. The conversion ratio is high at 4.55 in 2000, 4.72 in 2001, and 4.53 in 2002. This is a danger signal and means that there is wastage of leaf after weighment – either due to rejection of red leaf after withering, or due to loss of product caused by breakdowns.

Rejection of leaf after acceptance (and payment) is the most reasonable explanation of the very unusual conversion factor of 4.72 (in 2001). Applying the difference (between the normal ratio of 4.3 and the 4.72 achieved) to the annual intake would suggest a total wastage at Mata, after purchase or during process, of the equivalent of 126.8 tonnes of made tea - a production shortfall of 10%.

3. Yield of BI tea is very low - 983 kg/ha in the bumper year of 2001 and yield of TV was little better – 1,010 kg/ha in 2001; overall Mata yield is only 67% of the Rwanda average, just 71% of mountain tea best average (Kitabi), and only 30% of Sorwathé's yield (ref.1). Privatized Sorwathé high yield is often attributed to its having mostly swamp grown tea which is not so badly affected by the dry season. While this may excuse some hill estates Mata however has a high proportion of swamp tea as 58% of its BI tea and 67% of smallholder tea is planted on swamp land (ref.11)

Made tea yield of Nshili Kivu is pathetically low (351 kg/ha in 2001, 416 kg/ha in 2002, 543 kg/ha in 2003). The manager claims that manpower is not a problem but that the short day necessitated by trucking to Mata reduces productivity (see Section 7.3.18 Labor). But on his payroll figure (1,500 pluckers) the 5 Kg per person per day productivity would only improve to 6.7 kg for a full eight hour day.

4. Green leaf transport is a great problem for Mata. Of the three BI blocks, the furthest BI III is 26 km distant, BI I is around the factory, BI II is four km, and BI IV is three km. TV leaf transport distance varies similarly. The feeder plantation at Nshili Kivu is all BI planting and is 54 km distant from Mata. The earth road from Nshili Kivu is being repaired and the dry season journey is now only 90 minutes, but earth roads need annual maintenance to keep them passable.

5. Leaf transported during cool weather suffers the usual crushing, which causes low fine leaf counts, averaging about 65-68% (OCIR-Thé target is 75%). On the day this aspect was inspected (13 October 2004) the range was 61-75%, with some of the TV blocks producing the best returns – TV2 (75%) and TV1 (69% and 73%). Leaf from Nshili Kivu on this day gave counts of 63%, 64%, and 67%. Looking back at the records however, shows a much wider range. In September TV quality occasionally achieved as high as 85%, but was also as low as 49%. The factory has the authority to reject leaf below a count of 65% but this is very rarely enforced. Reasons given for leniency include that the farmers are learning, and that Nshili Kivu is a long distance and the roads are bad. Eventually a record book was shown in which the field weighment is compared with factory weighment.
6. Difference in the daily figures will include all losses - weighing errors, evaporation from bags during transport, and rejected leaf. Where leaf is rejected specifically because it is burned (excessively heated) during transport, this is noted in the margin. The notation is rare, yet the occurrence of burning must be very frequent.

5.4. General issues

5.4.1. Clones

The estates visited had a good selection of African assamica clones⁴, unfortunately these have been intermixed during planting at Kitabi, Mata and Nshili Kivu. They are separate at Gisovu and there are a few pure clonal areas at Mata. Separate planting and plucking allows the Tea Maker to optimize orthodox manufacture to suit the individual qualities of a clone – to produce a range of products. While a good overall product can be manufactured from mixed clones unless future pure clonal extension planting is done this admixture limits the product diversification at Kitabi.

None of the African clones being grown are conventionally suitable for green tea, which is normally made from *Camellia sinensis* types. Clones of this type would need to be sourced and planted for production of the finest green tea: note however that Indonesia makes some good green teas from *Camellia assamica* raw material., and that all the African clones are excellent for black orthodox tea.

⁴ Clones BB10, BB35, M110, TR6/8, 475, 100/5, 31/8 and K10/8

None of the clones seen in Rwanda had the large hairy bud that produces the very best and very expensive silver tips. In Sri Lanka the red leafed clone TRI 2043 is grown specifically for its hairy bud. There is also a clone in Kenya (S15/10) that has a hairy tip and may be suitable: cuttings should be obtained and propagated for trial and planting of a small area.

5.4.2. Yield

Yield of tea in Rwanda is, generally, depressingly low. For 2002 Gisovu returned 992 kg/ha of MT, while Kitabi produced 1,273 kg/ha, against the country average of 1,343 kg/ha⁵. As a benchmark, the privately operated Sorwathé factory yields 2,978 kg/ha from its 250 hectares. Most factories running at or below 1,000 kg/ha are likely to be operating at a loss.

Causes of low yield vary (see Box 2). The principal cause on the estates visited is the generally low level of fertilizer used, poor timing of application, and the complete lack of fertilizer in 2004. Hail and frost have had an adverse effect, but the consistently high yield of the Sorwathé estate serves as a local benchmark despite damage from these natural elements.

Note that yield can be improved by adequate and timely application of fertilizer, with appropriate modifications to plant husbandry and by adjusting plucking frequency. However yield improvement should not be undertaken without due regard to installed process capacity or a factory problem will simply be substituted for a field problem.

⁵ Mata produced 900 kg/ha in 2002, and Nshili Kivu was lowest at 416 kg/ha.

Box 2**CAUSES of LOW YIELD – Field Mediated Factors**

- Planted area wrongly measured or reported
- Abandoned tea included in planted area
- Planting includes low bearing old seedling tea
- Lack of fertilizer
- Badly applied fertilizer
- Imbalance of major nutrients (NPK)
- Deficiency of minor nutrients
- Soil pH out of acceptable range
- Rain fall insufficient or badly spread
- Pests
- Diseases
- Lack of sufficient pruning
- Some crop left unharvested – insufficient or unskilled labor
- Poor plucking technique – not selective
- Waterlogging
- Frost damage to table
- Hail damage to flush

Causes of low yield – Factory Mediated Factors

- Not all plucked leaf is processed – wasted due to insufficient capacity
- Not all plucked leaf is processed – wasted due to poor management
- Plucked leaf is rejected due to quality defects on delivery
- Made tea is rejected due to quality defects – faulty manufacture
- Power shortage, incorrect voltage, incorrect frequency
- Fuel shortage
- Insufficient labor
- Machinery breakdowns

5.4.3. Climate

The climate in Rwanda is seasonal with a hot dry season from June to August, rains in October, and again in March. Frost is a risk in July and August, and hailstones in September. Frost and hail destroys the flush and yield does not

recover until new buds develop. The estimated loss in revenue caused by frost at Mata in 2004 is US\$ 182,000 (calculated at a tea price of \$1.70/kg).

Frost protection measures are taken by Japanese tea farmers using electric fans in the fields to break up still air in frost pockets. Orange farmers in Brazil use water sprays to protect blossom on their trees. It may be worth running a desk exercise to check the cost benefit of using frost alleviation measures in Rwanda.

Rainfall pattern can be variable from year to year causing considerable yield variation. Similarly the cost benefit of introducing irrigation should be tested.

However, despite distinct seasonality (see Table 6) Rwanda does have all year round production of tea. Many successful tea countries have a dormant season caused by drought or by cold winter weather that restricts their production to only 5 or 6 months⁶.

Table 6. Seasonal variation in production – percent of annual production per month

Month	Gisovu	Kitabi	Mata	Nshili	Mean
JAN	9.4	9.9	9.7	9.0	9.5
FEB	9.5	9.2	9.3	8.6	9.1
MAR	11.6	9.9	9.8	7.9	9.8
APR	10.6	10.3	10.6	9.8	10.3
MAY	11.1	10.4	11.3	10.7	10.9
JUN	10.3	8.7	8.5	8.5	9.0
JUL	6.7	6.8	5.4	5.8	6.2
AUG	4.5	5.6	4.2	4.8	4.8
SEP	4.2	4.9	5.2	6.3	5.1
OCT	5.4	6.1	7.6	8.4	6.9
NOV	6.6	8.5	8.4	10.4	8.5
DEC	10.3	9.6	9.9	10.1	10.0

5.4.4. Fertilizer

Planned application rates are 600 to 700 kg of compound fertilizer formulated as 25:5:5:2MgO:1SO₄ in equal split doses applied before the two rains (spring and autumn). This is equivalent to an application of only 150-175 units of N per hectare or about one third of the normal application of N.

As well as a very light dosage, the timing of application is often delayed into the rains due to late delivery to the estates – this is wasteful as nutrients are lost by leaching during wet weather.

⁶ Assam, Darjeeling, Georgia, Japan, Malawi, and Turkey for example.

In 2004 there has not yet been a delivery of fertilizer, the last application being made in 2003 (except Kitabi, who held over their late delivery in 2003 to apply in January 2004). Delays in delivery of fertilizer could be eliminated if OCIR-Thé held a strategic stock of fertilizer, sufficient for at least one application, but preferably a whole year's supply.

While the cost of holding a strategic stock is high, so is the cost of late application (actually nine months late in 2004 for every estate and small holder).

At the planned annual application rate of 600 kg/ha for 13,000 ha the stock required would be 7,800 tonnes. OCIR-Thé pay US\$ 336 per tonne for fertilizer, requiring an outlay of US\$ 2.62 million. For a 12 month strategic reserve assume a finance cost of 15% - this is an additional cost of US\$ 393,120.

Late application of fertilizer will lose yield, and as late application is done in the rainy season, will incur leaching losses (dissolved fertilizer is washed down below the root level). While it is difficult to quantify the loss exactly, from experience the yield loss from a two month delay in application is estimated at 10% and the leaching loss could be 20%. An overall yield loss of 10% of 14,000 tonnes of tea at an average price of US\$ 1,600 per tonne is US\$ 2.24 million lost. Add to this a leached fertilizer loss of 20% of US\$ 2.62 million spent = US\$ 524,000. **This is a total annual loss to the industry of US\$ 2.76 million caused by late application. Even if these estimates of loss are halved, the finance cost of funding a strategic fertilizer reserve is only one quarter of the annual benefit.**

Nitrogen deficiency symptoms (young leaf chlorosis) were visually obvious on some blocks, particularly the Mata TV swamp plantings. Kitabi reports potassium deficiency symptoms (leaf drop) on 50 ha, but due to non delivery of ordered KCl this cannot be rectified. All managers report slow regrowth of flush after plucking. The low yields speak for themselves.

Nutrition of tea should be managed to secure the desired yield, while not sacrificing quality. When at its yield ceiling mature tea should be fertilized on a replacement basis – calculated on the net loss of NPK in harvested flush and prunings, and confirmed by regular tissue analysis⁷. This now standard tea management system is not yet practiced by OCIR-Thé.

⁷ Approximately 50% of all applied nitrogen is removed within the green leaf crop.

Price of fertilizer has been cited as a reason for low usage. While imported compound fertilizer is expensive to transport from Mombasa, and the fertilizer price paid by OCIR-Thé (US\$ 336 per tonne) is certainly more expensive than KTDA can buy at (US\$ 265 per tonne), it is still cheaper than the price Sorwathé, with less buying power, have to pay (US\$ 454 per tonne). Yet Sorwathé find it economic to fertilize sufficiently to achieve a yield 2.5 times as high as the Rwandan average.

Calculated as cost per unit of N applied, OCIR-Thé pay US\$ 1.34 per unit, while Sorwathé pay US\$ 1.82 per unit. The response of clonal tea to N is around 6 kg of made tea per unit of N applied (some clones can exceed 8 kg, ref.3). Priced at an auction average of US\$ 1.60 per kg this shows a return of US\$ 9.60 for every US\$ 1.34 spent on fertilizer – an excellent cost benefit regardless of the price difference between Kenya and Rwanda.

5.4.5. Leaf analysis

Plucked green leaf is routinely analyzed on receipt and scored for percentage fine leaf. The analysis is done jointly by representatives of BI and TV. Pluck standard varies with season and between BI and TV. The average across all factories is stated to be 67%, with a future improvement target of 80%⁸. Factories can in theory refuse to accept leaf below 65% fine, but this is rarely if ever enforced, and factory leaf analysis books record many loads accepted below this figure, despite heavy leaf crushing and the presence of heat damaged leaf.

Gisovu leaf intake averages 66-70% fine during dry season, 73-80% during the March to June quality season.

Kitabi averages 63-71% over the year (BI with 64-74%, TV with 63-70%).

Mata averages 63-75% (sometimes as high as 85% and sometimes as low as 49%). Block 1 TV can produce some very good plucking. Transport delays from Nshili Kivu can give whole truckloads of red (burned) leaf.

⁸ KTDA in Kenya commenced their small farmer operation in 1965 with an 85% fine leaf target, by 2003 this had slipped to 75%, a figure which is being maintained. For trials with orthodox tea production they were asked to improve pluck standard to 80% plus, which they did.

Overall, low fine leaf percentage figures recorded are mainly caused by transport damage rather than by poor plucking. We estimate that elimination of transport damage would add 5-8% to the average fine leaf count (i.e. from 67% up to 72-75%) without any change in plucking techniques.

5.4.6. Control

Management have direct control over the BI plantings, and can schedule harvesting of these by adjusting plucking cycles, and can control tipping harvesting and timing of pruning. However, there appears to be very little control over the amount of leaf delivered by the TV. The factory can nominate the number of days per week to pluck (wet season maximum of six, dry season minimum of three), but the amount of leaf brought to the factory is not known until it arrives. While yield is low this may be acceptable, but if yield is increased and factories work more often at (and above) their installed capacity some better system of control will be necessary to prevent overloading, and eventually, wastage of plucked leaf.

Extension advice was originally supplied to the TV farmers by the factory BI personnel, but by the choice of farmer's associations, this no longer happens.

5.4.7. Conversion ratios

The weight of green leaf required to make one unit of black tea is referred to as the conversion ratio. It is expressed as, for instance 4.3 : 1 (4.3 kg of green leaf to 1 kg of made tea) or as the percentage of black tea derived (in the above case, 23.26%).

The conversion ratio in a well run factory will fall consistently within the range 4.25 to 4.35. This range holds well between factories and even between countries. Whenever the annual average conversion ratio falls outside the range it is a danger signal that all is not well. Table 7 shows conversion ratios for all Rwanda tea factories in 2001 (ref.4).

Table 7. Green leaf conversion ratios at Rwandan tea factories

Factory	Conv. ratio
Mata	4.72
Gisovu	4.27
Shagasha	4.49
Nyabihu	4.25
Rubaya	4.02
Pfunda	4.43
Gisakura	4.64
Kitabi	4.02
Mulindi	4.33
Sorwathé	4.26

Factories falling within the acceptable range are boldened. Where the ratio is conspicuously low it must be suspected that excessively coarse leaf is plucked, or that plucked leaf dries out in transport before reaching the factory – effectively that withered leaf is purchased. Where the ratio is too high it typically indicates that leaf is being watered before weighment, or is being lost after weighment; this can be due to purchase of leaf of bad quality that is subsequently discarded, or loss in process due to break down of equipment, or made tea being stolen.

The very wide range across OCIR-Thé factories, and the absolute normality of Sorwathé as a local benchmark would justify further investigation as to the individual causes, and to seeking solutions. From observation during this visit departures are primarily due to poorly arranged transport, acceptance of below standard leaf, and product loss during process due to machinery or power breakdowns.

5.4.8. Transport

Leaf is brought in from the field in nylon sacks stacked 15 deep on open trucks, sometimes (though forbidden) with two helpers riding on the top. Small trucks have a 2,500 kg limit, larger trucks can be loaded to 6 tonnes. Many trucks, particularly those carrying TV leaf have a long journey over rough roads – up to 28 km at Mata, and 58 km from the BI plantings at Nshili Kivu. The crushing of leaf at the bottom of such loads is considerable, and during dry months the build up of heat is sufficient to cause pre-fermentation or red leaf (ref.5).

Plucked green leaf is alive and respire within the bags, producing heat that cannot escape. Respiration rate (and heat production) doubles for every 20°C rise in temperature, thus in the absence of external cooling by evapotranspiration, this heating up continues until the leaf cells die.

During wet seasons roads can become impassable leading to long delays in delivery. TV farmers cannot afford to maintain roads as the estates do within their boundary, nor to use a tractor to haul out a bogged down vehicle.

Transport is contracted out and some operators have been convinced to use boards between the loads to lessen the weight on the lower bags. Many of these boards are round poles rather than flat planks, and do not work well.

Leaf transport damage can be virtually eliminated by use of a) trucks with a hanging frame to ensure that no sack has any pressure exerted upon it (Uganda, and KTDA in Kenya) and b) the use of rigid stacking plastic crates (some estates in Sri Lanka and in South Africa). It should be noted that Sorwathé has adopted the use of rigid wire stacking leaf collection cages for the same purpose.

5.4.9. Machinery

Factory machinery is of mixed age and condition. Withering troughs are mentioned under heading Withering (Section 7.3.13). The CTC lines at Mata are very old and are not acceptable. One CTC line at Gisovu is old and cannot be used. Cutting lines are hand fed to vibratory leaf sifters: these lines should be fed using a metered system to ensure that downstream machinery is neither starved nor overfed – Sorwathé has installed this system that is now commonplace in CTC factories.

The GWA tub fermentation system (*tables roulantes pour fermentation*) is now an outdated system for continuous CTC manufacture and should be replaced with good quality CFU machines with forced draught cooling through a perforated bed. These units save labor, and reduce timing mistakes. The GWA system is however very suitable for fermenting the coarser orthodox fines, and should be transferred to orthodox manufacture.

Dryers are all Marshall Fowler FBDs of varying capacities and ages. These dryers too are old fashioned in design concept and it is recommended that OCIR-Thé purchase a Kilburn fluid bed dryer from India, to evaluate its quality and performance⁹ compared with the old MF design.

Sorting (triage) is generally acceptable for CTC, but the silo installation at Gisovu (30 large bins) appears excessive for a factory with so small a production. It is explained that tea has to be stored prior to packing, as packing can only be carried out when an invoice is received. This is an unusual system as most factories pack directly into sacks and make up invoices from these. The other reason given is that transport is often delayed, which may be so but tea can be stored as easily in sacks as bins, and from a moisture uptake point of view more safely.

⁹ Sorwathé have a Kilburn FBD dryer (India), as well as a Hambro FBD (Great Britain), and two CCC FBDs (Sri Lanka). Each of these is rated at 450 kg MT/hr.

5.4.10. Maintenance

While factories are kept clean and tidy the level of machinery maintenance is generally poor causing lost production and reduced product quality. Maintenance appears to be carried out on demand (when a failure occurs) rather than on a planned preventative maintenance program with scheduled replacement of machinery. This is no reflection on the factory engineers as it appears more to be a problem of obtaining permission to replace defective parts and systems.

Examples seen or discussed include:

Gisovu – defective temperature instrumentation on final stage of dryer.

Kitabi – problems in 2003 with cyclone vibration leading to fracture. This caused much loss of product and reduction in quality until finally replaced using thicker steel. Similarly, over fired teas in 2003 due to flash steam problems, resulted in loss of buyer confidence. Note that Kitabi final section inlet temperatures were still running high on 11-10-04, and dropped tea moisture was not being monitored. The target and actual inlet temperatures are considerably higher than Marshal Fowler FBDs are normally run at (risk of burning) and the target and actual exhaust temperatures are lower than normal (risk of dropping wet tea).

	Actual temperatures °C (11 October 2004)		Target temperatures °C		Normal settings for Marshal Fowler °C	
	Inlet	Exhaust	Inlet	Exhaust	Inlet	Exhaust
Stage 1	122	40	140	38	125-130	40-50
Stage 2	130	43	130	39	-	-
Stage 3	118	72	125	60	100-105	75-85

The entire steam reticulation at Kitabi appears to have faults. Fifteen withering trough radiators await renewal. Live steam and condensate leaks are common in the withering shed, condensate is being vented from the dryer, instead of being returned, steam is commonly vented from the boiler, and the dryer main steam feed gauge is faulty (reading off scale).

Mata – the ancient CTC machines are virtually beyond repair and must be replaced. The machinery breakdown record for Mata (counting a breakdown as a stoppage of more than 30 minutes) the season is 48 hours per month during one shift working. This will double to 96 hours during two shift rainy production and represents nearly four hours per day of lost production!

5.4.11. Power

Grid electricity supply has been particularly bad in the recent dry season, both in duration of stoppages (5 to 13 hours per day) and out of range voltage and frequency.

This has led to a huge increase in the use of diesel generated electricity by the factories using their standby generators. Some of these are old and perhaps less than well maintained, or may not be rated for continuous service as prime providers, and in consequence they are breaking down. Their power output is limited and not all the estate and factory services can be provided simultaneously. Kitabi reports that this year to September has required usage of diesel generators for 2,505 hours, compared with only 273 hours during the same period last year.

Production of electric power by standby generator is 2 to 2.5 times the cost of grid power.

Serious consideration should be given by OCIR-Thé to biomass co-generation systems for thermal and electric energy to eliminate dependence on unreliable grid power.

5.4.12. Fuel

Boilers are fuelled with eucalyptus timber from own plantings. Timber is felled, cut and split, and stacked during summer months. Some, but not all wood fuel is stacked under cover to maximize its calorific value. Gisovu (314 ha) and Kitabi (580 ha) have sufficient plantings for their own use, and Kitabi supplies some timber to Mata which does not have self sufficiency, but is negotiating for extra land for tree planting and will set up a tree nursery this year.

No obvious attempt is made to manage the fuel tree plantings as a sustainable crop. Trees are of very mixed sizes. Coppicing is irregular, and no fertilizer is applied. Again the good practice at Sorwathé should serve as an example.

5.4.13. Withering

Kitabi has 32 troughs (daily capacity 28,160 kg GL), Gisovu has 40 (daily capacity 32,000 kg GL), and Mata has 31 (daily capacity 24,800 kg GL). At a minimum loading of 800 kg green leaf per trough, and assuming that all troughs are in good working order, this gives each factory ample withering space to meet their installed capacity of 1,200 tonnes per annum (= 20,540 kg GL per day), however average seasonal peaks can theoretically add 30% to demand (= 27,000 kg GL per day) which would require Mata to increase loading to 871 kg per trough. However, the all time monthly highest leaf intake was 793,362 kg GL (Kitabi in January 2003) – this is an average daily demand of 31,735 kg GL, which should be met at Kitabi by increasing trough loading to a still quite reasonable 990 kg, though managers report regular overloading of troughs (1,200 kg plus) at peak time. Overloading troughs to this extent is unacceptable.

As noted above Kitabi has 15 troughs unusable due to radiator leaks, if these are not replaced before the peak season of December/January it will cause quality problems.

A full load of 20,000 kg GL has to lose 7,000 liters of water overnight. This is evaporated into the air leaving the trough. Wither air circulation has to be engineered to ensure that fresh ambient air enters the fan, and moist air leaves the building. Faults in building design lead to recirculation of moist air back through the fans. To overcome this fault requires the recirculated air to be heated to increase the wet bulb depression. While there are times when ambient air does not have a large enough depression for withering and heat is required, faulty design significantly increases this requirement – this costs money and reduces product quality.

Gisovu wither building design is excellent, with adequate ingress for fan air and egress for trough exhaust. Furthermore there is a curtain wall between fan inlets and troughs, effectively preventing recirculation. Heating is by ducted hot air, however: this is not a very controllable system and should be replaced by individual trough radiators (as at Kitabi).

Kitabi has a very poorly ventilated wither building, relying on only two rows of perforated masonry on either side for ventilating a total of 832,000 cubic feet per minute of air flow. There is no curtain wall and the degree of recirculation must be very high – and very expensive in extra fuel costs. The individual radiator system, mounted behind the fan, is of the required type.

Mata has troughs on two floors, with inadequate side ventilation though this has been increased slightly by opening up the end wall. There is a curtain wall but this has large openings cut into it that completely spoil its intended action, and through which trough exhaust air can be drawn back into the fans. Heating at Mata, like Gisovu is via ducted hot air.

At all the OCIR-Thé factories withering is calculated by weight loss (expressed as the inverse of water lost – i.e withered leaf taken off the trough that is 30% lighter than green leaf weight onto trough (30% loss in weight) is called 70% wither). This is a very old system and has long been superseded by using actual moisture content – in both CTC and orthodox factories. The reason for this is that field moisture can vary from 75% to 85% from season to season, or can vary by an extra 10% with wet weather. Withering to a fixed percentage moisture loss carries the differences through to the process line. This affects CTC cut, fermentation timing, and requires constant resetting of drier controls, as well as causing large variations in quality. Withering to a fixed final moisture content eliminates these incoming variations.

Withering to a fixed moisture content requires the use of a moisture meter. For orthodox manufacture withering has to be better controlled and withering control using the moisture content system will be necessary.

5.4.14. Quality control

Leaf analysis and wither moisture control have been dealt with separately. Factory quality control embraces process monitoring and product monitoring. The former should include leaf standard, green leaf moisture content, green leaf weight on trough, wither shed ambient WB and DB, withered leaf moisture content, line feed rate, checking CTC cut, fermenter air humidity, fermentation monitoring for duration, airflow and temperature, dryer inlet and exhaust temperatures, dryer steam pressure, dropped tea moisture content at 30 minute intervals, and made tea weight. Product quality monitoring considers grade quality after sorting, and normally embraces moisture content, particle size analysis (PSA), tapped bulk density, and tasting, though many tea factories will also add further chemical and physical testing.

OCIR-Thé factories do not employ a full range of process or product measurements. No factory was seen with a working moisture meter (perhaps the most necessary instrument in any tea factory). No factory was seen with undamaged calibrated airflow meters in fermenting. Many of the dryers lack full temperature instrumentation (Stage 1, 2, and 3, inlet and exhaust). No PSA checks are made on grade sizes.

Tasting was done on a regular basis and to a good standard – and while necessary, cannot substitute for the other standard QC checks that confirm a good tea, and prevent a bad tea being made.

5.4.15. Records

Records are comprehensive and well kept; when asked, factories managers could go to their files and extract data quickly and accurately. The annual report made by each factory to head office is very fully documented, and the comprehensive monthly reporting system is also a good running record. There is certainly no cause for lack of control due to paucity of records.

5.4.16. Shipping

Only Kitabi can receive ISO container trucks at the factory. Mata and Gisovu must use loose pack sacks for container stuffing in Kigali. Kitabi cannot palletize, strap and wrap tea sacks and fill containers in the normal manner as it does not possess a fork lift truck, so they loose stuff containers. They were also unhappy about “losing” pallets if they were to palletize loads¹⁰, though this is normal tea industry practice.

5.4.17. Planning

A production target is made for each factory each year (green leaf harvest, made tea production, and conversion ratio). These targets are consistently missed – achievement runs at an average of 60-67% and even in the bumper year of 2001 the targets for the factories inspected were not exceeded.

This consistent under achievement indicates over optimistic (unrealistic) planning. All planned targets should be achievable or their management value is lost.

¹⁰ A subsequent conversation suggested that Rwandan axle loading legislation precludes standard containerization with palletized sacks (strapped and shrink wrapped at 20 sacks per pallet), and that sacks must be separately positioned within a container to achieve the correct loading. This was not verified. If it is true it is legislation that the tea industry should lobby against as it restricts competitiveness and adds cost to already expensive road freight.

5.4.18. Labor

Mata is the only estate with a declared shortage of labor, though there appear to be a great number on the pay roll. Factory manning is greatly in excess of that in most other tea countries¹¹.

Plucker productivity is a problem, particularly for Mata with low skill levels and many inexperienced young pluckers. Mata pluckers achieve about 15 kg/day (20-25 kg/day in **the rains**). Nshili Kivu too has a very low productivity level (around 5 kg plucked leaf per man day), but has no problem with recruitment. The low productivity is attributed by the manager to the short working day due to the last truck for Mata leaving at 14.00, but pluckers actually only lose two hours. On the same short day basis Kitabi pluckers would achieve 30kg/day rather than their rainy season average of 40 kg/day (30 kg/day in dry).

Incentive schemes are in place to improve plucker productivity, but they seem to be aimed only at the wet season: a productivity improvement during the dry season would be more useful – for example Kitabi BI pluckers tend to go absent when they know a dry season block in its final prune year is scheduled – the low yield makes it not worth their effort to pluck at the standard pay rate.

For the TV farmers too, a price differential of 2 FRW per kg (an increase in price of 3.6%) hardly compensates for the work of plucking finer to achieve above 71% fine leaf. About 20% do receive the extra payment but with the vagaries of transport damage it cannot be a certain way to increase income.

5.5. QC equipment list

OCIR-Thé factories are ill equipped and lack the most basic QC and process monitoring equipment.

Full listings of the QC equipment and process monitoring equipment recommended for a black tea factory are given in Appendix 11, together with equipment needed for small scale tea flavoring. There is some duplication across lists that, in a small factory, could be eliminated to reduce costs.

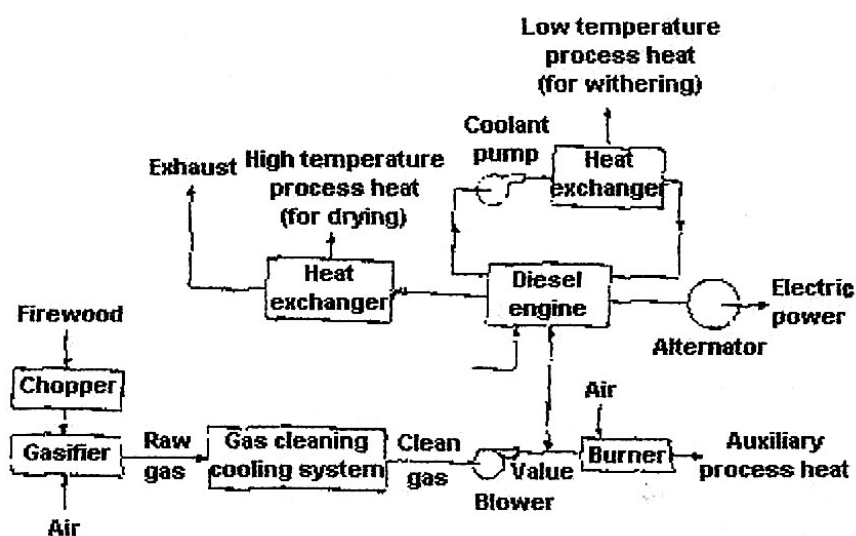
¹¹ Factory manning level at Mata is more than three times the number per tonne manufactured as at Brooke Bond CTC factories in Kenya.

5.6. Cogeneration

Rwanda faces a growing problem with supply of grid electricity – long periods without power, and voltage and frequency fluctuation interrupt production; this problem must be resolved. **Manufacture of one tonne of tea requires 450 kWh of electric power (ref.12) and it is impossible to run a tea factory effectively without a continuous and reliable supply.** Generation of electric power using stand-by diesel generators is an expensive alternative to grid power. Running a high voltage power line to new factories (such as Nshili Kivu) is capital intensive, and its implementation depends also on there being sufficient central generation capacity to provide power consistently.

An increasing number of developing world industries are turning to ownership of their own power generation systems, based on hydro-energy or biomass fuel. Cogeneration or CHP (Combined Heat and Power) provides a very efficient system for local generation of electricity and thermal energy. For a tea factory, with a typical peak requirement of 1 to 2 mW electrical energy, a timber fuelled diesel cogeneration system is both highly sustainable and produces thermal and electrical energy in the right proportions matching the process needs (70-75% thermal, 25-30% electrical). Cogenerative systems of this size use large diesel engines run typically on biogas to produce electric power, recapture waste thermal energy from the generator (exhaust and cooling water) and convert this into usable thermal energy, supplemented where necessary by burning biogas produced from timber fuel. **Of the several CHP systems available the wood gasifier diesel engine cogeneration system is found to be the most suitable for the tea industry (see diagram below).** Alternative systems (hydro, gas, and steam turbines) tend to be larger than required, and offer the wrong power to heat ratio. AHP in Kericho, Kenya use a combination of sustainable energy resources - micro hydro power generation (MHP) and diesel co-generation (CHP), to supplement grid power for their seven tea factories. Many tea factories in Asia are introducing biogas co-generation from timber fuel, energy saving and recovery methods, and solar energy heat collection, to reduce operation costs and to foster manufacturing sustainability. **As with organic and fair trade claims, sustainability can also be used as a marketing tool.**

The diagram below (from ref.8) shows a typical biomass fuelled diesel cogeneration unit suited to the needs of a tea factory:



**Wood Gasifier Based Diesel Engine Cogeneration System
for the Tea Industry**

Biomass co-generation capital and running cost in an African context needs to be checked further. The comparative investment costs for alternative methods in India per kW of production for typical installations are:

Solar thermal system	US\$ 3,730
Small hydro station	1,950
Wind farm	1,405
Biomass power	710

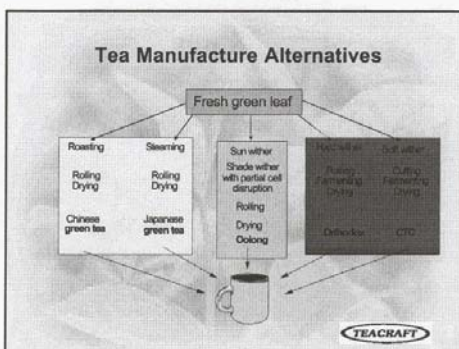
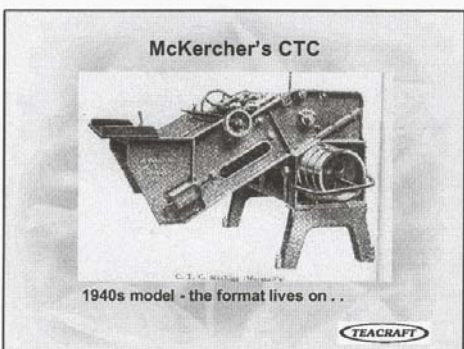
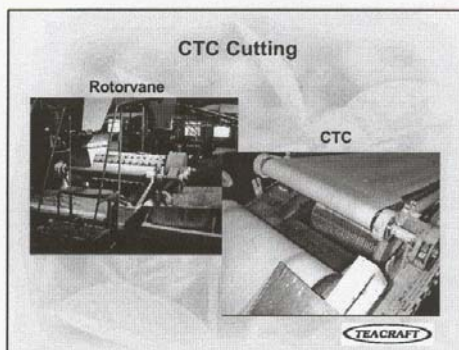
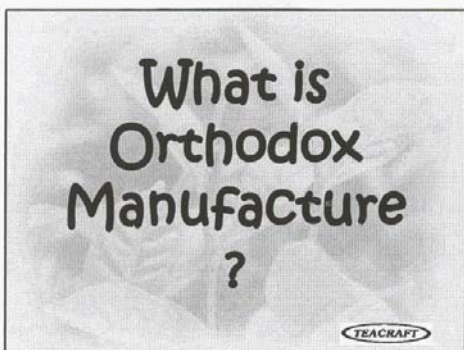
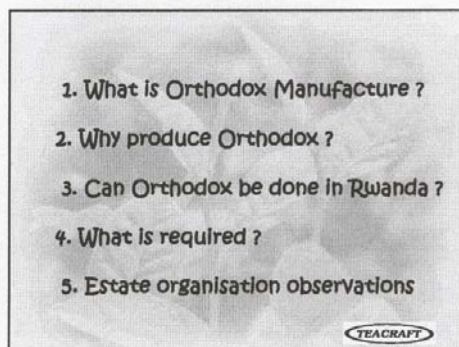
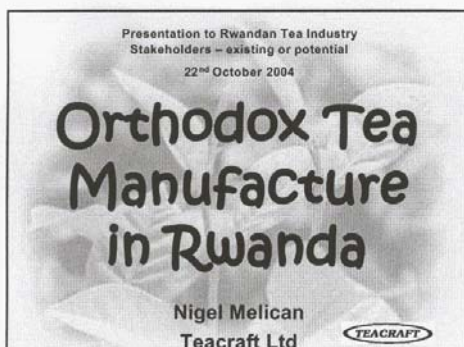
Payback period calculation will depend on the local grid power cost that it replaces, but as an example, at the Indian State Electricity Board off peak tariff costs, a three year payback period would be typical.

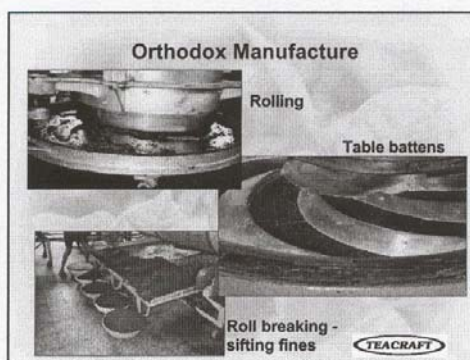
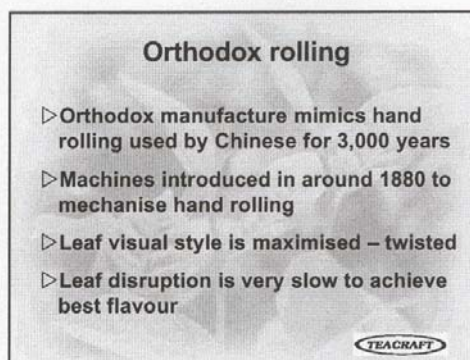
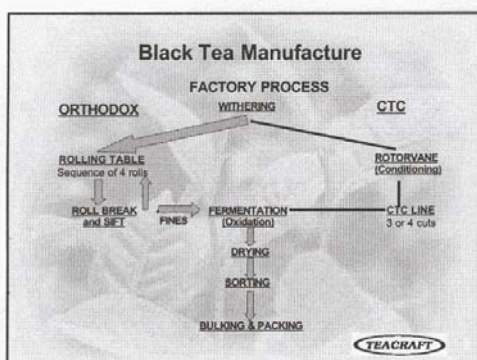
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7. GENERAL APPENDIX

7.1. Orthodox Tea - PowerPoint presentation, 21 October 2004





Grades	Broken Fannings Dust
Leaf	Granular
Liquor appearance	Good depth of colour without milk Golden / reddish colour with milk
Taste	Good thickness and mouthfeel Rounded and smooth, some with briskness Less flavour than Orthodox
Performance	Rapid colour delivery High level of soluble solids on leaf surface More suitable for tea bag users Preferred by consumers that use milk Can be too thick for some markets



Grades	Leaf Broken Fannings Dust
Leaf	Twisted or curled - can be stylish - can contain silver or golden tips
Liquor appearance	Lighter colour than CTC Clear red without milk Yellow / greenish hue with milk
Taste	Strong initial taste impact Usually combine strength & astringency High seasonal flavour is possible Often some origin specific flavours
Performance	Slower infusing Tightly rolled leaf looks in some solids Do not 'cream down' when cooled Long leaf can be brewed longer without bitterness Preferred by consumers that do not use milk Less liked by consumers that do use milk



CTC	Orthodox	
Primary	Leaf	Broken
BP1	TGFOP	TGFOP
PF1	TFOP	GOF
PD	GFOP	FBOPF
	FOP	BOFF
D1	OP	FOF
Secondary	FP	OF
F1	F	OPF
BMF		BP
D		PF
	Dust	
	BOPO	CD
	PD	RD
	Off grades	
	BM	D
	F	FD
	BMF	





US cents/kg

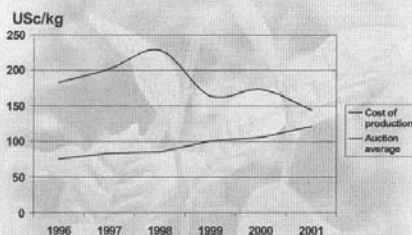
Year	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
2000	118	115	112	110
2001	125	132	125	118
2002	110	108	105	102
2003	100	98	95	92
2004	95	92	90	88

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Year	CTC	ORTHODOX
1997	850	800
1998	950	850
1999	900	900
2000	950	900
2001	900	900
2002	950	800
2003	1050	800
2004	1000	800
2005	1100	700
2006	1150	800
2007	1100	800
2008	1150	850
2009	1150	800

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Sri Lanka - price margin



Sri Lanka Dept. Census & Stats, 2001
& Central Bank of Sri Lanka, 2002

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Old products - losing ground

- ▷ Standard CTC teas
- ▷ Bazaar sales from the chest
- ▷ Standard loose tea in packets
- ▷ Standard branded teabags
- ▷ Imports poorly packed at origin

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New Products - trends gaining ground

- ▷ Specialty black teas – premium orthodox leaf grades
- ▷ Specialty green teas – display teas
- ▷ Single estate & regional origins
- ▷ Flavoured teas
- ▷ Fruit and herbal blends
- ▷ Organic teas
- ▷ Novelty teas
- ▷ Nutraceutical beverages
- ▷ RTDs - lifestyle and greens

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Specialty tea value addition - China



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Value Added Orthodox Teas

- ▷ The trend - to specialty teas, away from standard CTC teas
- ▷ The market - specialty tea is still a niche in US and Europe, but now at 11% and growing
- ▷ The products in demand – high quality orthodox black, green and flavoured teas
- ▷ Action needed – commence manufacturing and test marketing now – Kenya has already begun

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Costs and Returns

- ▷ Typical Cost of Production
 - ▷ CTC US\$1.20 per kg
 - ▷ Premium O'dox US\$1.60 per kg
- ▷ Typical ex Factory Selling Price
 - ▷ CTC US\$1.20 to 2.50 per kg
 - ▷ Premium O'dox US\$ 4 to 10 per kg

Some rare ones achieve US\$ 250 per kg

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Potential Return from Specialty Orthodox

For 1,800 tonnes black orthodox tea:

COP	\$2.88 million	@ \$1.60 per kg
SP	\$7.20 million	@ \$4.00 per kg
Margin	\$4.32 million	

For 1,800 tonnes CTC tea:

COP	\$2.16 million	@ \$1.20 per kg
SP	\$3.24 million	@ \$1.80 per kg
Margin	\$1.08 million	

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Specialty Orthodox - Growing Markets

USA - tea sales have reached \$5 billion and are set to reach \$10 billion by 2010

CANADA - follows USA trends, teenage market particularly keen on tea.

MAINLAND EUROPE - niche high value markets rapidly growing in northern Europe

JAPAN - luxury black teas and green RTDs showing strong growth

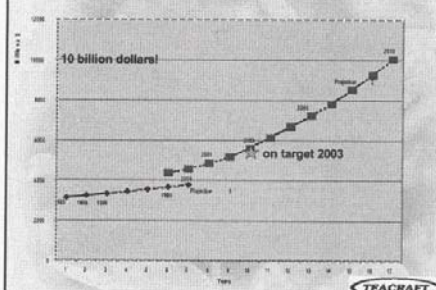
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SPECIALTY TEA - USA

- ▷ The Specialty Tea Market is the fastest growing segment of the Tea Industry in the USA – retail tea value now increasing by 20% annually
- ▷ There is room for additional tea origins in the Specialty Market, and particularly good enthusiasm for new African origins
- ▷ South African Rooibos is the only recognised African origin in the US Specialty Tea Market
- ▷ Rwanda is not known in USA for tea, though it is becoming recognised for quality coffee.

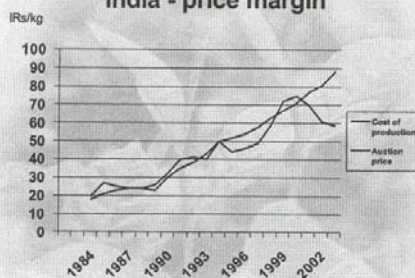
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Projected Growth in US Tea Sales



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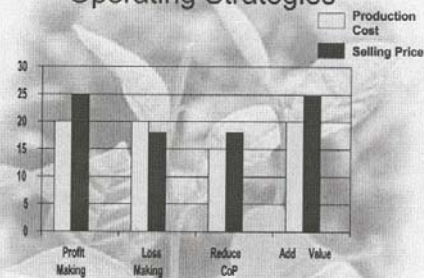
India - price margin



LTS Vol 2, #1A2 pp 62-64

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Operating Strategies



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"Traditional" Value Addition

- ▷ Packing and Branding - building trust
- ▷ Fulfilling consumer demand – meeting trends, supplying demand
- ▷ Engineering consumer demand - creating demand: modern marketing

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Tea - Value Addition Methods

Specialised manufacture

Branding

Tea bagging

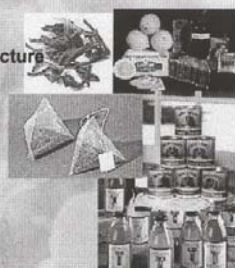
Flavouring

Organic

Instant tea

Decaffeinated tea

RTD teas – cans & bottles



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Can Orthodox be done in Rwanda ?

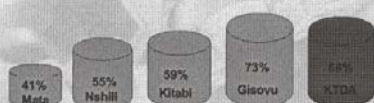
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Yes, and well !

- Good clones
- High altitude
- Good soil
- Good plucking
- Potential for specialty production

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Suitability Scores for Orthodox

Field and factory
aspects considered

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How much Orthodox tea ?

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ontheFRONTIER Rwanda tea strategy

In seven years time:

YIELD 1,431 kg/ha → 2,400 kg/ha
 PROD'n 16,000 tonnes → 35,900 tonnes
 TYPE 100% black CTC
 → 75% black CTC
 13% flavoured tea
 6% green tea
 5% orthodox black = 1,800 tonnes
 1% organic

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What is required?

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Machinery list for Orthodox Line

▷ Line capacity 400 - 500 tonnes

▷ Withering troughs with individual radiators	x 8
▷ Rolling tables	x 4
▷ Roll breakers	x 2
▷ Rotorvane 8" diameter	x 1
▷ Fermenting trolleys	x 30
▷ Wall humidifiers	x 3
▷ ECP tray dryer with 3 circuits & radiator	x 1
▷ Myddleton sorter	x 1
▷ Macintosh sorter	x 1
▷ Trinick sorter	x 1
▷ Algaier sorter	x 1

Assume sufficient steam from existing boiler

Approximate price US\$ 275,000

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Gisovu Factory

- ▷ Space can be made in existing factory by moving some machinery
- ▷ Clones are planted in separate blocks allowing some optimised products to be manufactured
- ▷ For best control BI green leaf would be utilized, at least initially
- ▷ Some new clones would be raised for TV planting



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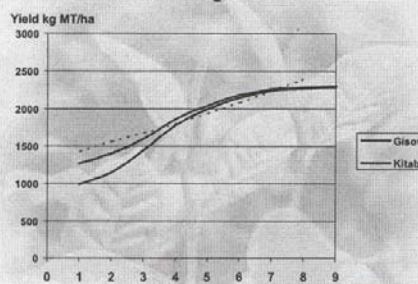
Kitabi Factory

- ▷ Space exists between two units for an orthodox line
- ▷ Clones are mixed at Kitabi
- ▷ Conversion ratio is bad indicating poor leaf transport – for sake of control orthodox production would be based on adjacent BI leaf
- ▷ Some urgent maintenance work is required



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Increasing the Yield



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Rwanda Tea Issues - FACTORY

- ▷ Machinery is old
 - ▷ Machinery is not best quality for the job
 - ▷ Breakdowns are frequent
 - ▷ Maintenance is on demand not preventative
 - ▷ Replacement is outside control of factory
 - ▷ No effective process monitoring
 - ▷ No effective QC
 - ▷ Costs are relatively high
- These issues can be resolved, but Confidence in the industry's future is required to encourage investment, and incentives need to be offered
- ▷ Grid power is unreliable
- This is a central issue

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Rwanda Tea Issues - MARKET

- ▷ Auction is not Marketing - modern selling methods are needed
- ▷ Image - building customer awareness
- ▷ Generic promotion - exposure, exposure, exposure
- ▷ Direct selling - products specified and contracted
- ▷ Delivery - of goods and service, on time, every time
- ▷ Market presence - global knowledge
- ▷ Exploiting niche markets - speed and accuracy; innovative interpretation of trends
- ▷ Good customer relations - effective communication essential
- ▷ Coordination - everyone working in the same direction

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Mission - for Rwanda to be
recognised and respected as a

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Mission - for Rwanda to be
recognised and respected as a

**World Centre of
Excellence for
Specialty Tea**
starting with ORTHODOX

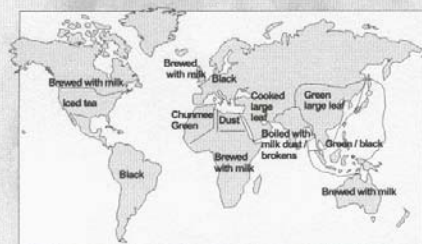
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BACK UP SLIDES

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Tea – Regional Consumer Preference



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Case study: Nepal Tea**Seven years ago:**

- ▷ disorganised tea industry
- ▷ poor quality
- ▷ very low yield
- ▷ badly equipped factories
- ▷ no external markets
- ▷ poor or unknown image overseas
- ▷ bureaucratic government restrictions
- ▷ no investor confidence

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Case study: Nepal Tea**Actions taken:**

- ▷ set up HOTPA tea producers export association
- ▷ lobbied government to relax restrictions
- ▷ encouraged production of top quality tea
- ▷ introduced quality control of tea for export
- ▷ sending samples to overseas buyers
- ▷ attending international tea shows
- ▷ internet presence
- ▷ held own international tea conference
- ▷ building confidence to attract private investment
- ▷ selling overseas via Nepali expatriats
- ▷ working to build a generic Nepal brand and image

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7.2. Sample itinerary for benchmarking tour of Sri Lankan Tea factories

Itinerary for Georgian Tea Study Tour – Sri Lanka 2003

25th May. Arrival at Colombo International Airport at 9:45 am. Transfer to Trans Asia Hotel Colombo by coach for lunch in Colombo. Then proceed to Galle for dinner and overnight in Light House Hotel.

26th May. After breakfast, 9:30am leave to Kundupukande Tea Estate in Galle. The distance from Induruwa to Kundupukande is approximately 15 miles or about 45 minutes. This estate is a typical Low country plantation and is one of Sri Lanka's finest low grown factories. The factory has all of the state of the art orthodox machinery and has the latest manufacturing procedures. The teas produced by this factory always fetch high price averages at the Colombo tea auctions. Then lunch at Light House Hotel. After lunch check out and return to the Kundupukanda Tea Estate to see the bought green leaf operation, and proceed to Royal Palms Hotel in Kalutara for dinner and overnight.

27th May. Morning leave to Colombo after breakfast. Morning visit to the Tea Board of Sri Lanka, and late morning attend the tea auction in Colombo. The Colombo Auction is the largest tea auction held in the world selling approximately 5 million kg of tea every week in Colombo. **NOTE Tour Organisers need Passport Numbers ahead of time for tour participants so that Security Passes can be issued.** Lunch at approximately 1 pm in Colombo at Rajabojun. Then visit a leading tea export company (Heritage Teas Ltd, a j/v with Mitsui, Japan) in order to see a very well equipped packing plant with latest tea bagging machines, and packeting machines for regular and organic teas. Late afternoon, leave to Kandy via Peiyagoda. Dinner and overnight in Mahaweli Reach Hotel.

28th May. Morning, leave Kandy and visit Delta Tea Factory in Pussalawa. This factory was previously an orthodox tea manufacturing factory, but is now converted to CTC manufacture as the managing company felt that the leaf produced by the plantation and the local climatic conditions were better for CTC manufacture. Distance from Kandy to Delta estate is about 20 miles or about 1 hour. Late lunch at Mahaweli Reach Hotel. Evening free for sight seeing in Kandy including the Botanical Gardens and Temple of the Sacred Tooth Relic. Dinner and overnight at same hotel.

29th May. After breakfast leave Kandy and proceed to Ginigathena to visit the renowned Kenilworth Tea Factory and Estate. Distance from Kandy to Kenilworth is about 1.5 hours. This estate usually fetches some of the highest prices in the region. The plantation is extremely well kept. Lunch at Rest House in Hatton. Then proceed to Nuwara Eliya for dinner and overnight at Grand Hotel. Distance from Kenilworth to Nuwara Eliya is about 2 hours.

30th May. After breakfast leave to Great Western Tea Factory and Estate in Talawakelle. This is one of Sri Lanka's finest plantations, not only in its production but for its advanced management techniques incorporating HACCPs and Japanese Five S methods. Proceed to Kandapola for late lunch at Tea Factory Hotel on Heathersett Estate. View museum of tea machinery at hotel. Dinner and overnight at hotel.

31st May. Return to Colombo via Pinnawalla to see the elephants at the Elephant Orphanage and lunch at the Elephant Trust museum guest house. Dinner and overnight at Trans Asia Hotel, Colombo.

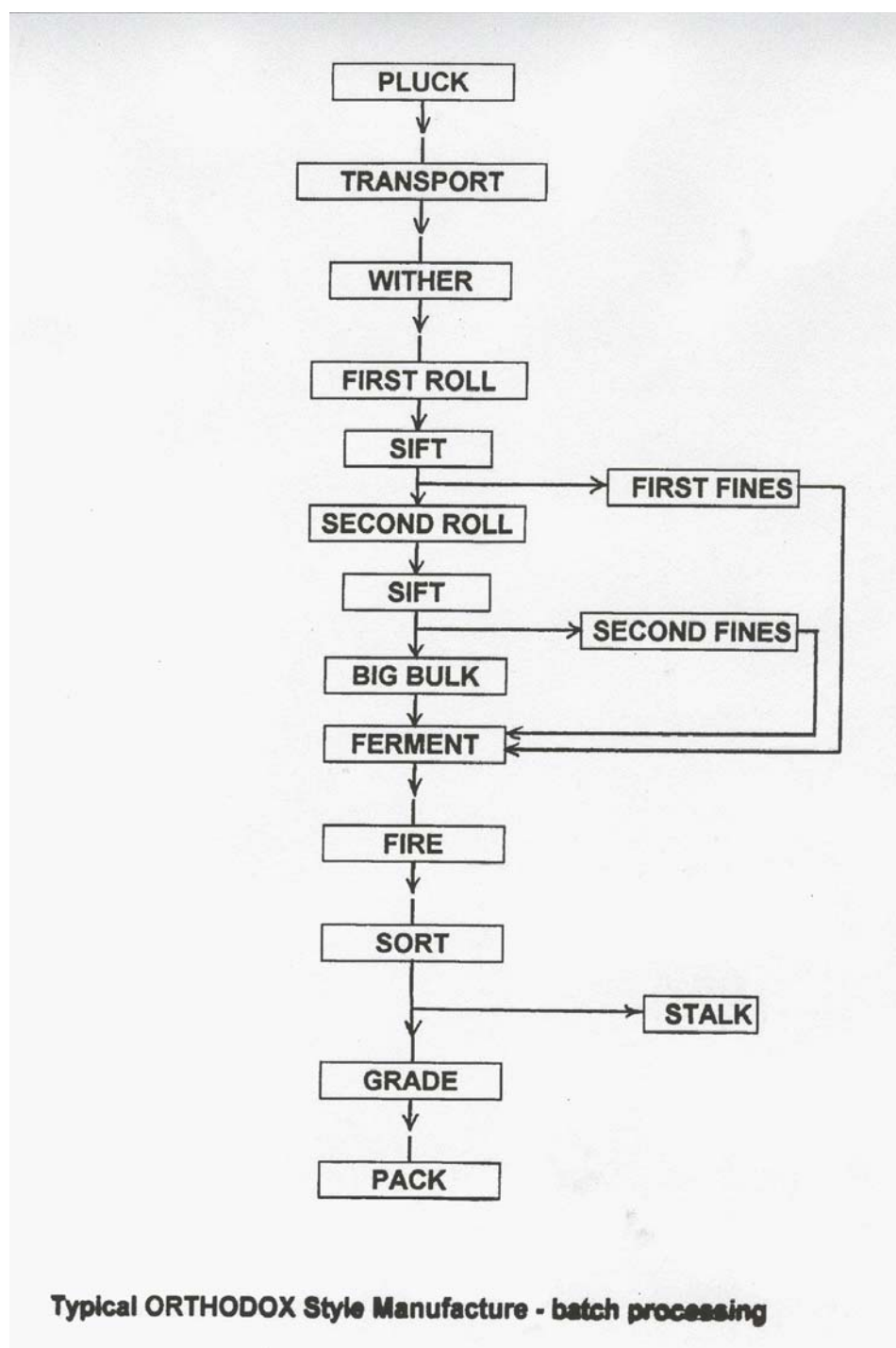
1st June. Free for shopping and sight seeing in Colombo including visit to Colombo museum. Own arrangements for lunch. Special farewell dinner with wine at exotic Beach Wadiya seafood restaurant. Overnight at Trans Asia Hotel.

2nd June. Depart for Colombo International Airport.

The tour is very well planned and will cover all aspects of Sri Lankan tea growing and production. It was personally arranged by a well known Sri Lankan tea packer and exporter who deals with FSU countries. The package includes a local tour guide travelling with the group, who speaks English and Russian. The tour company (D Holidays) is a reliable operator and regularly organises tours for foreign groups including Japanese and Russians.

Transport will be by luxury 30 seater coach and all participants will be in single en suite rooms in good quality hotels.

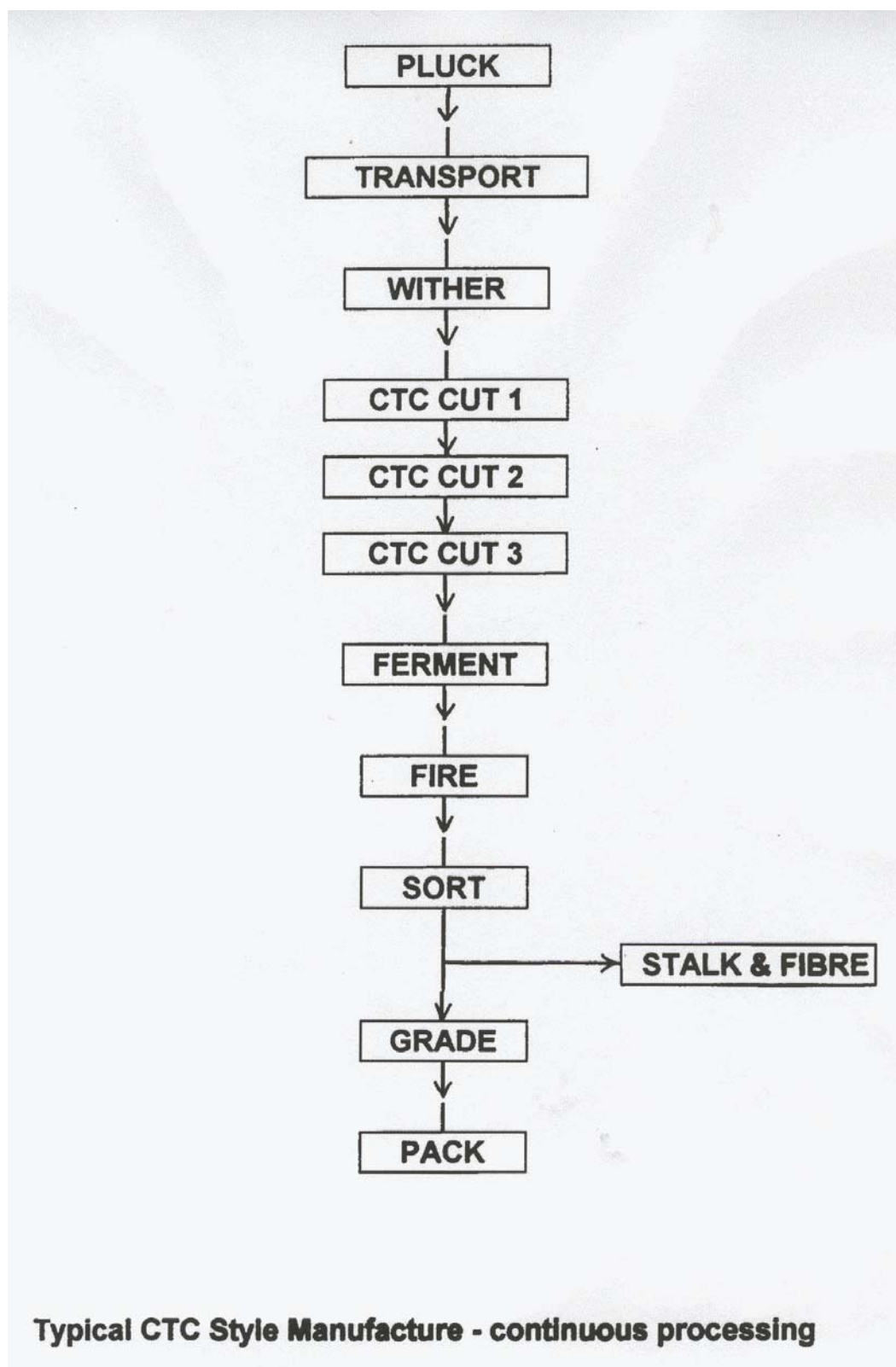
7.3. Flow chart for black orthodox tea production



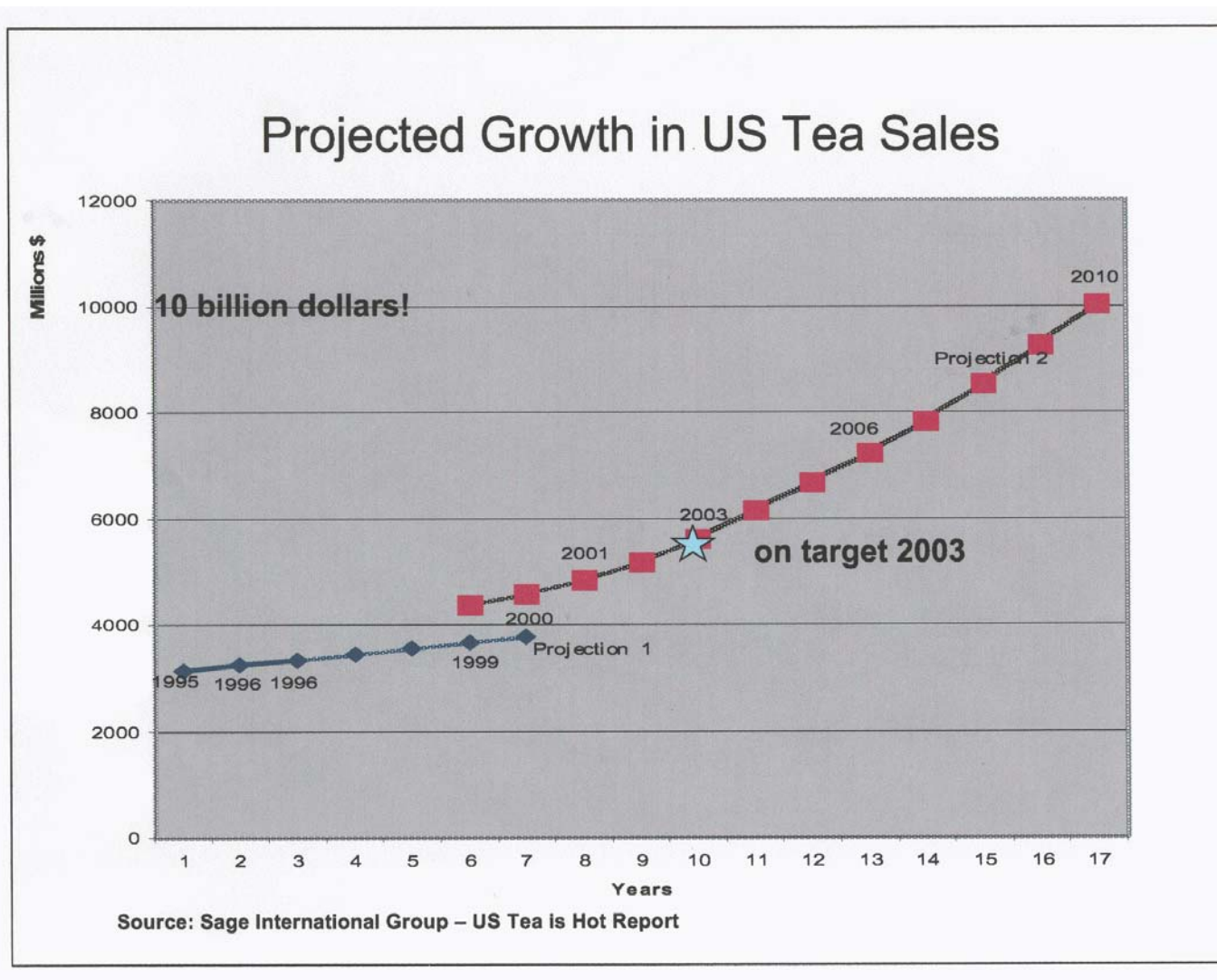
7.4. Flow chart for green tea production



7.5. Flow chart for black CTC tea production



7.6. USA retail tea sales projection to Year 2010



7.7. Air freight quotation for tea export Kigali to New York

Client : Mr Melican

Date :20/10/04

Facture proforma n° 242 SF

Type de marchandises : Tea

Nombre de colis :
 Poids Brut en Kg : 750
 Poids taxable en Kg : 750
 Volume M3 4,50018

Aéro de départ : Kigali

Aéro de destination : JFK
 NEW YORK

Fret Aérien Kgl - JFK	750 x 4,05 USD =	3.038 USD
Security surcharge :	750 x 0,15 USD =	113 USD
Fuel surcharge :	750 x 0,36 USD =	270 USD
Lta :	=	15 USD
Cha:	750 x 0,12 USD =	90 USD
Frais Kigali:	=	100 USD
Frais de Transit à BRU:	=	25 USD

3.650 USD

Total :

~~EAST AFRICAN CARGO~~
 KIGALI
 NEW YORK

FRAGHT COST FOR TEA: KIGALI TO NEW YORK

= US \$ 4.87 per kg

7.8. News item "Low orthodox output may hamper tea exports"

Business Line

INTERNET EDITION

Date: 22/10/2004 URL:

<http://www.thehindubusinessline.com/2004/10/22/stories/2004102201041400.htm>

Low orthodox output may hamper tea exports

M.R. Subramani

G.K. Nair

"Our product mix is skewed in favour of CTC tea, whereas the global demand is for orthodox teas."

Chennai/Kochi, Oct. 21

EVEN as tea exports are showing a rising trend, lack of adequate facilities to produce orthodox tea is causing concern. Industry players feel this could hamper the country from taking advantage of the current situation in the global market.

"We are facing a problem of product mix. There is a great demand for orthodox tea but since we produce more of CTC (crushed, tear, curl) tea, we are unable to service all the demand," industry sources said.

Mr Anil K. Bhandar, President, United Planters' Association of Southern India (Upasi), told *Business Line*: "Our product mix is skewed in favour of CTC tea, whereas the global demand is for orthodox teas".

Initially, 90 per cent of tea produced in the country was in orthodox form. But with the erstwhile Soviet Union buying huge quantities of CTC teas, the product mix changed in its favour.

"Now, we produce 90 per cent of tea in CTC form and the rest in orthodox form," said Mr Ullas Menon, Secretary-General, Upasi.

Ever since the dissolution of the Soviet Union, tea exports to the region, now known as Commonwealth of Independent States (CIS), have tapered off to around 60 million kg from a high of over 150 million kg. Exports to the CIS region are declining because Sri Lanka and Vietnam have emerged as key suppliers at competitive price.

Sri Lanka, besides being competitive, is also offering longer credit facility apart from expressing willingness to buy arms from Russia.

"This year, we are seeing good demand from places such as Iraq, Iran, Libya which consume lot of orthodox tea. We have to take steps to service these markets," the sources said.

Changing the product mix in favour of orthodox involves considerable cost. "An additional Rs 7-8 a kg will have to be spent to produce orthodox tea and given the current situation the industry is in, it is not possible to spend that much amount," Mr Menon said.

Mr Bhandari said: "We have requested the Union Government to consider an incentive



Are you someone who has an interest
in Agriculture and Agro Tourism?

Sri Lanka

*If so you have come to the right place.
We could take you through*

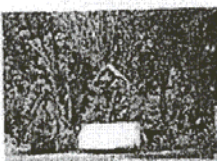
- ◇ Paddy cultivation systems, which have being developed through 2500 years of history.
- ◇ Huge Ancient irrigational tanks that were built by our ancestors utilizing their unprecedented skills and knowledge that stuns the modern world.
- ◇ Provinces that produces finest spices
- ◇ Lush green Carpet like plantations that produces the best tea in the world
- ◇ Unbelievable variety of tropical fruits.
- ◇ Rubber & coconut plantations that run in to miles.
- ◇ Vegetable plots & Dairy farms in the cool hills.
- ◇ Traditional "Chena" cultivation systems.
- ◇ Organic and pesticide free cultivations and home gardens.



On special requests we could guarantee a hundred percent organic and pesticides free food and beverages during your entire stay.

**Accommodation would be arranged at the sites
themselves in**

- ◇ Humble houses of traditional paddy farmers.
- ◇ Treetop "chena" Huts- where wild elephants can't reach you.
- ◇ Posh colonial planters' bungalows, farmhouses in the cool hill country.
- ◇ Campsites in dairy farms etc.



In order to get the first hand experiences

You can try your hand at Milking early in the morning, Tea plucking with the traditional tea pluckers, Rubber tapping under expert guidance, or even tough work in the paddy fields. You may share their meals learn their treasured systems, coming from generation to generation.



7.9. Examples of tea agro-tourism

Host Companies

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Green Field Bio Plantations Pvt Ltd

107

Green Field Bio Plantations has established itself as a bio plantation synonymous with multi-crops associated with herbs, fruits, spices, coffee (Arabica), Oolong tea and exotic vegetables are being grown very successfully at their estate – Thotulagalle. This estate produces organic tea – bOP, BOP Fannings, Dust grades, Pekoe Fannings, OP and BOP1 and Flowery BOP/F, green tea and herbal tea as well as blends that suit the needs of their customers.

The company is registered with the Fair Trade Labelling Organisation in Germany. Thus, the tea produced and sold in the international market with Fair Trade Label fetch a social premium, which goes direct to the welfare of the workers. The tea produced at Thotulagalle is marketed in bulk as well as in value-added tea bags and packs. These are marketed in Australia, Japan and the UK. Farmers and Growers Limited (UK), IMO, SKAL and JAS (Japan) have also certified the estate.

Desired cooperation

Green Field Bio Plantations is looking at developing agro tourism in a farm environment with an EU partner. They are also looking at developing agro tourism chalets so that tourists can get a first-hand experience in living in a farm environment.

No. of Employees	:	372
Year of Incorporation	:	1997
Annual Sales Turnover (in €)	:	780,467
Import Value 02/03 (in €)	:	Not Disclosed
Export Value 02/03 (in €)	:	263,538

Sri Lanka

<http://euslpart.com/prodcompany.asp?ID=107>

02/10/2004

Agrotourism

Destinations

Chiang Mai

Chiangrai

Loei

Samut Songkhram

Nakhon Si Thammarat

Chiangrai

Chiangrai is getting popular with nature lovers and more adventurous tourists, since there are still little-explored parts to be found in its many mountains. The hilltribes have abandoned opium in favor of cold-climate fruit, vegetable and cut flowers, and little plantations of these can be found in the most remote corners, since they are now accessible by road. A trip to these little planter communities offer a chance to explore both the agriculture and the ethnic diversity that has always been a major part of Chiangrai's charm.

Ban Hua Mae Kham Agrotourism Center

Tumbon Mae Salong Nai, Amphoe Mae Fah Luang Tel: (66-53) 765-277

Ban Hua Mae Kham is a hilltribe community comprising four distinct ethnicities: Hmong, Akha, Lisu and Muser. The village is located some 100 kilometers from the provincial capital—the last 33 of which being dirt road—and is officially the last Thai community in this corner, separated from Myanmar by an easily-crossable mountain range. Because of the altitude, the area is ideal for cold-climate flowers and vegetables, but commercial growing is still new.

The Agrotourism Center, run by the Department of Agricultural Extension, offers a tour of the farms and plantation in the area, and accommodation in simple ethnic-style huts with spare furnishings and running water. Reservations are recommended. Day trips are possible only if you start very early. A trip to Phaya Phrai tea plantation (off-road vehicles only), where fragrant Oolong tea is grown for export to Taiwan, is a must. The terraced plantation in the morning mists is one of the most romantic scenes to be found anywhere in the North. Tea-tasting is elaborate and fun, and at the end of it you will want to take home a packet of each.

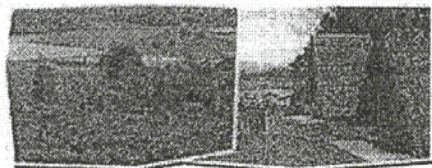
The best times to visit Hua Mae Kham are during the Lisu New Year celebrations (late January to early February), and the cool months from November to January, for the wild flowers.

http://216.239.59.104/search?q=cache:obJim83r2hwJ:www.tourismthailand.org/adv_act.php%3Fmodule%3Dspecial_act%26file%3Dspe... 02/10/2004



Malaysia

Sri Timor & Penusu Air Hitam



Kampung Sri Timor is a traditional Malay kampung about 25 kilometres from Kluang town, next to the Padang Hijau Recreational Park, Tea Plantation, Gunung Berlumut and Gugusan Felda. The majority of the inhabitants here are farmers who manage fruit orchards like durians and jackfruit, orchid planting project, coffee processing, rice and also snack foods.

The government dairy farm is another one-stop recreational spot for a real back-to-nature experience. Experience the thrill of horse back riding, canoeing, boating and fishing. Other activities include: Animal Farming, Veterinary Museum, Equine, Water Sports, BBQ and Farm Stay.



Eco-Tourism | Agro-Tourism
Johor Bahru | Endau Rompin | Kota Tinggi | Pontian
Kluang | Mersing | Segamat | Muar

Virtual Malaysia - Malaysia Tourism Portal

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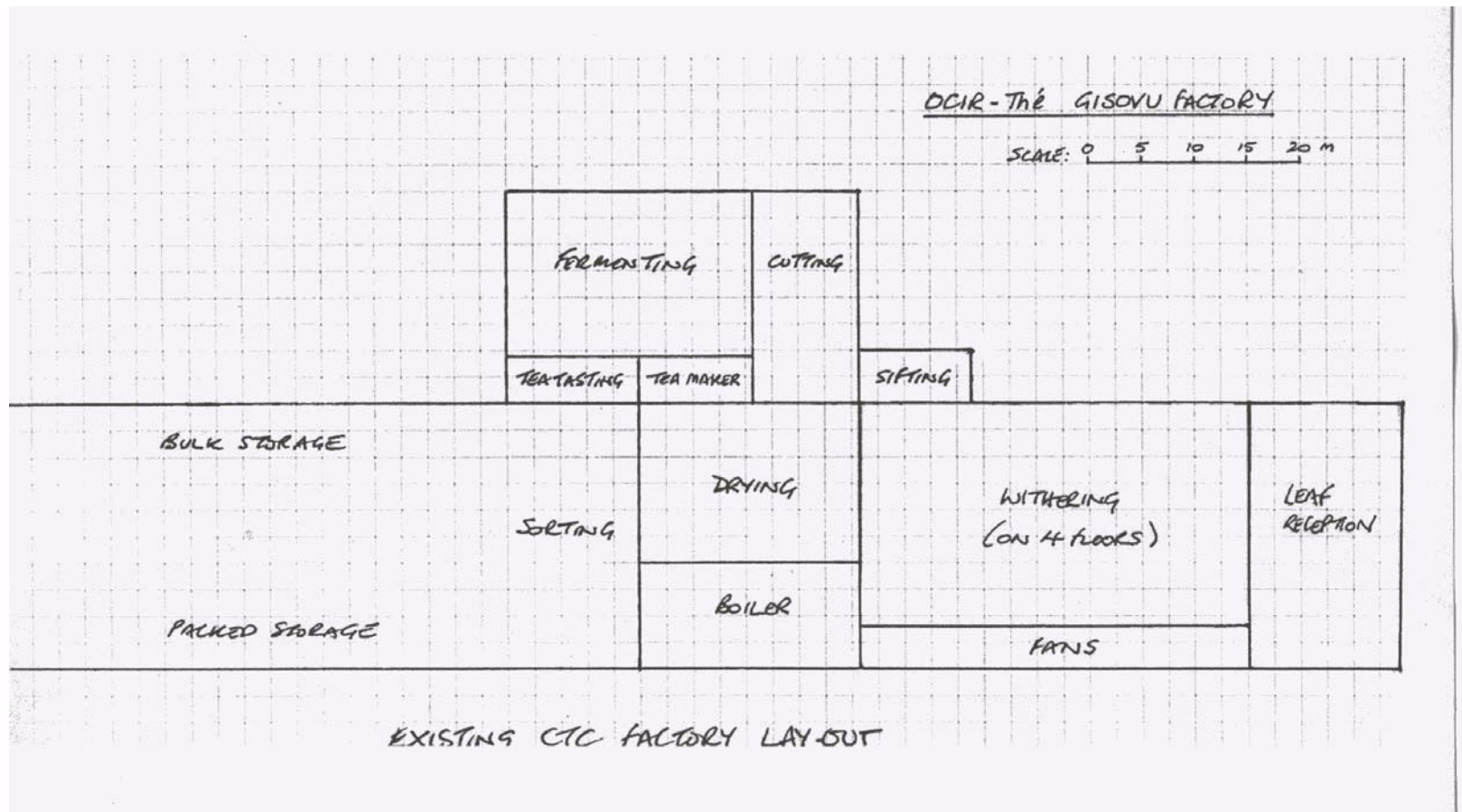
:: Johor Lowland Tea, Johor

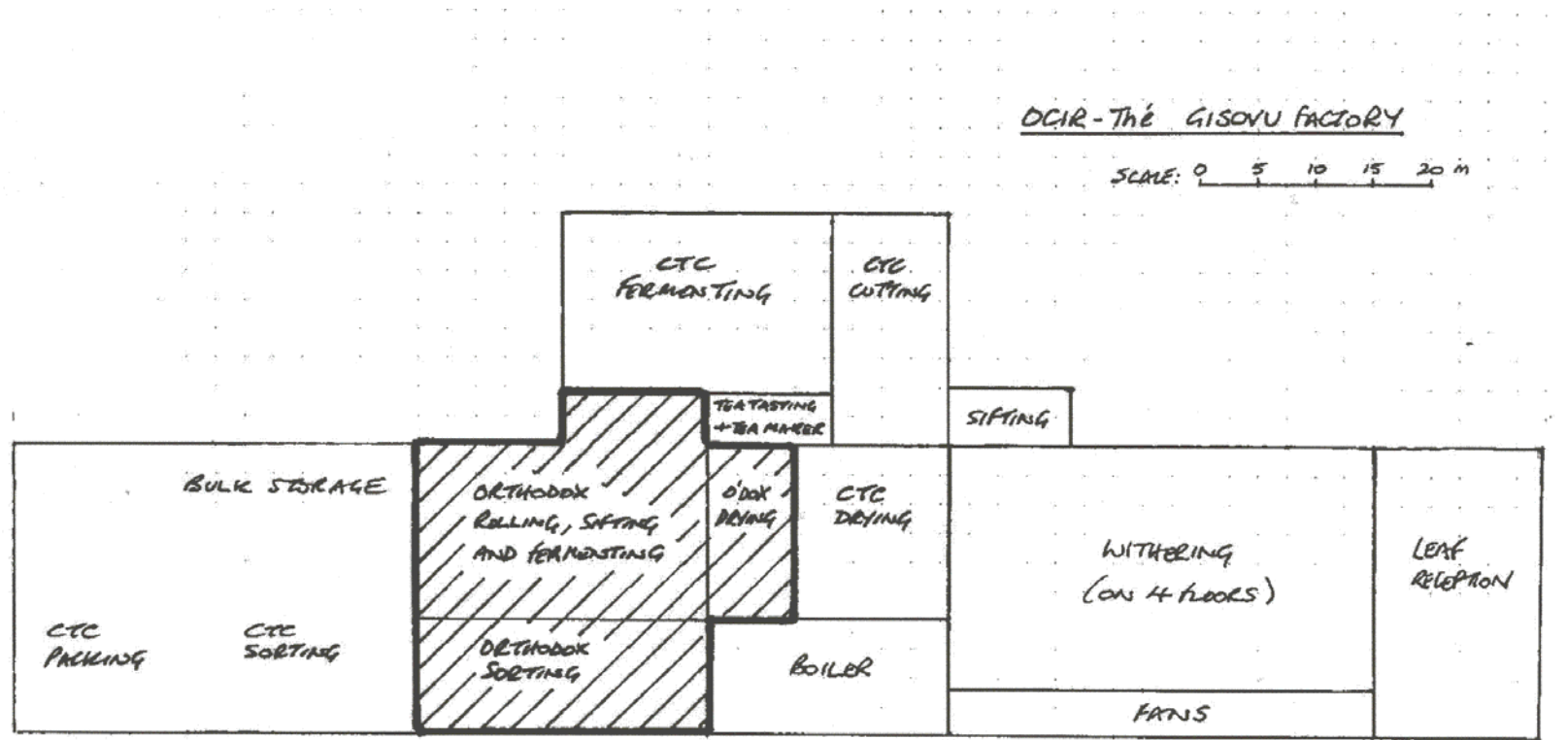
Category : Highlands

From the junction at the main road (Jalan Mersing) to Gunung Belumut is Johor's lowland tea plantation. This 260 ha of lowland tea garden lies in the valleys of Gunung Lambak and Gunung Belumut. It offers an opportunity for tea lovers to have a closer view of an actual tea plant and to appreciate the various steps needed to process raw tea leaves into final products ready for consumption.

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7.10. Gisovu floor plan showing positioning of orthodox tea equipment





SHOWING POSITIONING OF 500 TONNE ORTHODOX LINE

7.11. Quality control and process monitoring equipment for tea factory

Recommended QC and Process Monitoring Equipment for Small Scale Tea Flavouring

Tea warehouse

1. Indicating thermometer and hygrometer
2. In sack EHR moisture probe (Hygrometer)

Flavouring laboratory

1. Disposable pipettes x 1,000
2. 10 cm Petri dishes x 200
3. Sieve shaker
4. Set of 200mm sieves (x10 meshes) with receiver and lid
5. Balance to 500g x 0.01g precision
6. Balance to 3,000g x 0.1g precision
7. AMB-50 moisture analyser
8. Tapped density volumeter with spare 250ml cylinder
9. Dual input digital thermometer
10. 100mm rigid probe to suit digital thermometer
11. Naked tip thermocouple with flexible lead
12. ISO Tasting crockery (full size) x 36 sets
13. Sample display tray x 36 sets
14. Kettle (3 litre) electric automatic x 2
15. Electronic count down timer with alarm x 1
16. Heat sealer x 1
17. Foil laminate heat sealable sample bags (100 x 150mm) x 1,000
18. Layflat polythene tubing (150mm width)
19. Plastic labware (assorted beakers, measuring cylinders)
20. Fan assisted drying oven of 50 litre capacity (for calibration of factory moisture meters, and for drying soluble solids determinations)
21. Small refrigerator for storage of reagents and flavour samples and reference samples.
22. Water deioniser

Production area

1. Platform scale to 100kg by 10 g precision
2. Polyethylene bags of suitable sizes
3. Bag ties
4. Labels
5. Storage cartons, approximately 40 x 40 x 60 cm, with plastic liners
6. Buckets and bowls for small scale blending

Much of this equipment can be sourced locally. For difficult to find equipment please contact Teacraft Ltd <sales@teacraft.com>

Tea Quality Control Laboratory

Standard equipment

1. Sieve shaker
2. Set of 200mm sieves (x10 meshes) with receiver and lid
3. Balance to 500g x 0.01g precision
4. Balance to 3,000g x 0.1g precision
5. AMB-50 moisture analyser
6. AMB-50 printer in security case
7. Tapped density volumeter with spare 250ml cylinder
8. Binocular microscope (x25 power)
9. Bench pH meter
10. Dual input digital thermometer
11. 100mm rigid probe to suit digital thermometer
12. Tasting crockery (full size) x 36 sets
13. Crockery trays x 3
14. Sample display tray x 36 sets
15. Kettle (3 litre) electric automatic x 2
16. Electronic count down timer with alarm
17. Heat sealer
18. Foil laminate heat sealable sample bags (100 x 150mm) x 1,000
19. Layflat polythene tubing (150mm width)
20. Plastic labware (assorted beakers, measuring cylinders)

Recommended extra equipment

1. Fan assisted drying oven of 50 litre capacity (for calibration of factory moisture meters, and for drying soluble solids determinations)
2. Conductivity meter (for quick check on soluble solids)
3. PT₁₀₀ thermometer as a calibration standard
4. Reflectance colour meter for checking graded tea colour
5. Transmittance colour meter for checking tea liquor colour
6. Turbidimeter if clarity is an issue
7. Lab equipment to check theaflavin and thearubigen levels in made tea (spectrophotometer and glass labware, plus solvents and reagents)
8. Small refrigerator for storage of reagents.
9. Water deioniser

Further extra equipment required if quality assessment is to be made to meet the ISO 1572:1980 International Standards for Tea Quality

1. Bench muffle furnace for ash determination
2. GLC or HPLC for caffeine determination
3. Equipment for soluble solids measurement (reflux glassware, steam bath, etc).

Factory Monitoring Equipment

Essential items for effective process monitoring in a tea factory

1. Dual input digital thermometer (K type)
2. Naked probe (K type)
3. 200 mm rigid probe (K type)
4. 1,000 mm rigid probe (K type)
5. IR non contact thermometer
6. Wet and Dry Bulb digital hygrometer with %RH, WB and DP
7. Air velocity/volume anemometer
8. Casella float type anemometer
9. Manometer to measure to 1" water gauge
10. Optical and contact tachometer for rotary and linear measurement
11. AMB-50 moisture analyser
12. Hygrometer bulk tea moisture meter
13. Tapped density volumeter
14. Sieve shaker
15. Set of 10 sieves in various mesh sizes
16. Multimeter (volts, amps, ohms)
17. Clamp type amp meter
18. 3 metre steel measuring tape
19. pH test papers (range 3 to 8)
20. Temperature test strips (for ECP dryers)
21. Foil paper laminate heat sealable sample bags (100 x 150 mm)
22. Polythene bags (200 x 300 mm)
23. Stop watch
24. Electric torch
25. Spare batteries for all instruments
26. Adhesive tape

7.12. The world's most expensive tea

The Sunday Tribune - Spectrum

Page 1 of 3

Spectrum

The Tribune

Sunday, October 31, 2004

This tea is a connoisseur's delight

The world's most expensive tea is grown in an estate in Sri Lanka. Aruti Nayar visits Handunugoda

According to a legend, in China the best teas were manufactured untouched by hand. These were special teas presented to imperial rulers and to dignitaries of the court. Golden scissors were used to cut the tender tea leaves which fell into a golden bowl and the pickers wore white silk robes. The only time the tea came into contact with the human anatomy was when the emperor, to whom the white teas were presented, drank it. The Zong dynasty emperor Haizhong is said to have proclaimed that "White tea is a culmination of all that is elegant."

The tea estate seems an appropriate setting for an Oriental fable because of the ambience that makes a willing suspension of disbelief possible. The Handunugoda tea estate of planter Malinga Herman Gunaratne in Tittagalla, a part of the Galle province, about 160 km from Colombo is the place where recently the world's most expensive tea, white tea, was launched. A professional planter working for British sterling companies for over 25 years, Herman, after nationalisation, was appointed Regional Manager of the Nuwara Eliya Region, Sri Lanka's prime tea region. He was in charge of 67,000 acres of the Island's best tea lands. The estate has been with Herman's family for more than a century, it was in Nuwara Eliya district of the Central Province that he learned to update his skills as a planter.



Malinga Gunaratne and David Kilburn displaying white tea on the Handunugoda tea estate in Tittagalla



Jade Kilburn robing the white tea bush in a

<http://www.tribuneindia.com/2004/20041031/spectrum/main4.htm>

18/11/2004

After 42 years in the tea business, Herman's belief was that Ceylon tea, served with pride during his parents and grandparents time, might be swallowed by multinationals and vanish. It was this conviction that spurred on the Sri Lankan tea planter to team up with friend David Kilburn, a British aficionado settled in Korea, and turn what might have remained an Oriental fable into reality. As Herman puts it, "Kilburn is a committed tea man. He calls himself a student of tea and has managed to penetrate the secret world of tea through his research and travels. He has travelled widely in the tea-growing areas of the world. It is from him that I learnt the need to make specialty teas as opposed to the mass market teas that India and Ceylon produce and market."

ceremony at the launch

Kilburn, a tea historian, lives in Seoul with his Korean wife Jade and is Chairman of the Tea Museum there and had, on a visit to far off tea lands, heard of this ancient practice of growing white tea. He suggested that Herman should try to grow it on his estate.

The idea of reviving the ancient practice was further reinforced after Kilburn's visit to the city of Grass in France where he met a famous Nose (a man who noses perfumes and has the ability to differentiate between the different ingredients which go into the composition of a perfume). The Nose had before him many canisters of jasmine perfumes from different countries. When Kilburn asked him about the difference between these perfumes because they were all derived from the same jasmine flower, the Nose had answered, "The only difference is the difference in the smell of sweat from the hands of the pickers of flowers from the various countries." It was obvious that the ancient Chinese had mastered the art of making teas uncontaminated by sweat or oil from human hands. If the same was to be repeated, it would definitely create a storm, felt Kilburn.

Named after Kilburn, whose inspiration had motivated Herman, Kilburn Imperial is a white tea because it is not fermented and put through a process of firing but allowed to wither in the sun. The tender-most innards of the tea bud (the bush is a secret) are prised out with gloved hands to be sun-dried under surgically sterile conditions, without any direct contact with human hands.

Connoisseurs will have to pay through the nose for the white tea since it is priced and retailed at a staggering 1250 US\$ per kilo while the whole sale price is around 750 US\$, 750 times more than the average price of high-quality pure Ceylon tea.

This makes it the world's most expensive tea commercially marketed. Only available at Malinga Herman Gunaratne's tea plantation and Kilburn's tea museum in Seoul, the production of white tea is about four kilograms per month, roughly 48 kg annually, while the demand is much more. Silvery white in colour, it is shown to visitors against the backdrop of a black cloth. Once it is brewed, its colour is a rich brown. The tea is produced only from select tea trees and can not be harvested throughout the year. It loses its colour in inclement weather. The leaves can be used for a second or third brewing and the aroma is rich,

the flavour and taste delicate. There are many modern-day emperors and the ruling elite who do not find the cost prohibitive. Also produced on Herman's estate are many flavoured teas, among them tulsi and cinnamon tea. Says Herman, "Tea presents some very exciting prospects and since this plantation is my own I can experiment with various configurations of manufacture."

As Herman shows one around the tea estate, he bemoans the fact that despite being the largest producer of tea, Sri Lanka is lagging behind in innovative ideas for its famous export. As he says, "Today India and Sri Lanka both market tea as the world's cheapest beverage. This is wrong. Tea is too precious to be sold cheap. It has an astonishing array of health benefits which have to be exploited for the benefit of humankind and more importantly for those millions of plantation workers who toil tirelessly on our hillsides, working for a small wage. We cannot pay them what they deserve on the pittance that we get from marketing mass-produced teas. Without support from either industry or the government and the niche market for exotic higher-end teas remains unexplored. This was my motivation to go in for specialty teas."

HOME



<http://www.tribuneindia.com/2004/20041031/spectrum/main4.htm>

18/11/2004

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